Universität Basel
Wirtschaftswissenschaftliche Fakultät

January 2018

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WWZ Working Paper 2018/06

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A publication of the Center of Business and Economics (WWZ), University of Basel.

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Does Central Bank Transparency and Communication Affect Financial and Macroeconomic Forecasts?*

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January 26, 2018

Abstract

In a large sample of countries across different geographic regions and over a long period of time, we find limited country- and variable-specific effects of central bank transparency on forecast accuracy and their dispersion among a large set of professional forecasts of financial and macroeconomic variables. More communication even increases forecast errors and dispersion.

JEL Classification: C23, C53, E37, E58, D8
Keywords: Central bank transparency, central bank communication, central bank independence, inflation targeting, forward guidance, macroeconomic forecasts, financial forecasts, panel data models with truncated data

*We thank Nicolas Albacete, Alex Cukierman, Beat Hintermann, Bo Honoré, Massimiliano Marcellino, Cyril Monnet, Marcel Savioz, Heinz Zimmermann, and an anonymous referee for valuable comments and suggestions. In addition, we profited from the comments of participants of the SNB BrownBag Seminar, the Economics Lunch of the University of Basel, and the BuBa-OeNB-SNB Workshop 2017. We also thank Bettina Eberhard (BIS) and Paul Moser-Boehm (BIS) as well as Simon Dépraz for their help in collecting the central bank communication measure. A prior version of this essay was published as *SNB Working Paper 2017-12* in October 2017. The views, opinions, findings, and conclusions or recommendations expressed in this paper are strictly those of the author(s). They do not necessarily reflect the views of the Swiss National Bank (SNB). The SNB takes no responsibility for any errors or omissions in, or for the correctness of, the information contained in this paper.

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1 Introduction

Until not so long ago, central bankers believed that monetary policy decisions should take the markets by surprise in order to achieve maximum impact. In the last two decades, there has been a shift to a policy of increasing transparency with respect to goals, strategies and the basis on which decisions are made. This development is closely linked to increased central bank independence (CBI), which calls for a counterbalance in the form of transparency and accountability. Economic benefits are deemed another key reason for enhanced transparency. As summarized by Freedman & Laxton (2009), it is generally believed in the central banking community that providing more information about monetary policy may increase its effectiveness. This view is based on theoretical and empirical research that emphasizes the importance of expectations about monetary policy as a key element in determining interest rates and other asset prices.[1] By bringing market behavior in line with monetary policy objectives, the likelihood of sharply differing views on policy actions is reduced. In turn, more certainty about when the central bank will set the policy rate and its magnitude can reduce the volatility of market interest rates, increase the central bank's leverage over longer-term interest rates, and smoothen the incorporation of policy actions into asset prices. Similarly, Blinder (2007) argues that the major purpose of communicating with the markets is to condition expectations about future monetary policy.

To transmit the views of the central bank to the public and to markets, an improvement in the effectiveness of monetary policy through greater transparency requires proactive and well-planned communication. Hence, a great deal of attention has been paid to the way central banks present their key messages (for instance, Blinder et al. (2008) and Haldane (2017)). It is expected that central banks will communicate more actively after than before the crisis (Blinder et al. (2016)).

Parallel to the shifts in the practice of central banking towards more frequent communication and greater transparency, an expanding body of literature has emerged. In theory, both positive and negative effects are likely. Empirical work has been focused on inflation, financial markets, or private forecasts. A general finding is that transparency and communication reduce volatility in fi-

[1] Survey forecasts are an approximation for expectations in an economy.

nancial markets, enhance the predictability of upcoming rate decisions, and help achieve the monetary policy goals, vindicating the switch to greater openness in central banking.

Our paper contributes specifically to the empirical relation between transparency, communication, central bank design and private forecasts. In a broader context, we provide empirical results for the theoretical literature on the social value of information (see, for instance, Morris & Shin (2002), Hellwig & Veldkamp (2009), and Lorenzoni (2010)).

We run panel regressions to examine whether increased transparency and intensified communication by central banks affect the quality and the cross-sectional distribution of forecasts. The question posed is closest to those of Middeldorp (2011), Dovern et al. (2012), Ehrmann et al. (2012), Neuenkirch (2013), and Naszodi et al. (2016). However, we extend the analysis along various important dimensions and provide compelling evidence that is in contrast with the literature.

i We are the first to document an increase in the number of speeches held by central banks over time using the Bank for International Settlements (BIS) central bankers' speeches database. Based on it we compiled a new measure of central bank communication. It measures communication directly and comprehensively by the number of speeches. The number of speeches allows us to question the benefits of intensive central bank communication. We interpret a speech as a signal sent by the central bank. The more signals, the more precise and accurate should forecasts be. The theoretical foundation is a Bayesian expectations framework. Previous work makes no clear distinction between transparency and communication or focuses only on single aspects of communication.

ii We highlight an econometric issue in the estimation method that does not seem to have been recognized in the literature, and we offer an accurate alternative. The issue is that residuals follow a pattern when the dependent variable (either absolute cross-sectional mean forecast error or cross-sectional standard deviation) is not taken in log. There is a clear-cut lower bound to the value residuals assume in the setting without log.

iii We create an exceptionally large panel of 73 countries from all world regions and observations from 1998 to 2014 for financial and macroeconomic data.

The question is whether there is a one-size-fits-all policy for central bank communication and transparency. Unlike previous studies, which have in common a limited number of advanced economies (at most around 30) and relatively short periods of observations and forecast variables, the data set we compiled allows us to widen the scope of the inquiry in terms of the number of countries, their heterogeneity, the period of investigation and the variables to be forecasted.

iv Our data set also allows us to account for several important economic events, such as the Great Moderation, the financial crisis and the global recession, as well as the substantial modifications to central bank practices in their wake, in particular forward guidance. We also analyze the effect of inflation targeting and central bank independence.

v We compute optimal levels of transparency.

Overall, the evidence presented in this paper suggests a more balanced conclusion about the merits of communication and transparency in enhancing the predictability of monetary policy than has been reported in the literature.

First, the evidence for communication is uniform and quite compelling: more-frequent communication increases both forecast errors and their dispersion. The increased central bank communication seems to have resulted in cacophony and did not help investors and academics improve their macroeconomic forecasts. We link this result with the discussion about optimal monetary policy committees' size and form.

Second, while more-frequent communication increases both forecast errors and their dispersion, we find hardly any evidence, in contrast to previous papers, that transparency improves the accuracy of private forecasts. At best, the impact is ambiguous. However, if it is significant, transparency tends to reduce the forecast heterogeneity of interest rates, yields, and especially inflation. In general, the results depend strongly on the country region and the variable underlying the forecast. A detailed analysis of the various transparency dimensions yields interesting insights. Greater procedural transparency makes interest rate forecasts less accurate in Eastern Europe. At an even higher level of detail, we find that the publication of voting records makes interest rate forecasts more inaccurate, particularly in Western countries, and a prompt announcement of the main

operating instrument or target increases the inaccuracy of yield forecasts.

Third, additional analysis provides information about other factors that have an effect on the precision and distribution of forecasts. i) The zero-lower-bound constraint tends to reduce forecast errors and the dispersion of short-term rates, but it has no effect on yield forecasts. ii) By contrast, the political and institutional framework in which central banks operate yields contradictory results. While central bank instability is associated with less-accurate forecasts and with increased dispersion, central bank independence does not exhibit uniform effects, partly reducing forecast inaccuracy but mostly increasing it. iii) More uniform is the evidence pertaining to inflation targeting, which yields more-accurate and more-homogeneous inflation forecasts, more homogeneity in interest rate forecasts and, in Western countries, enhanced alignment of yield forecasts. iv) The next set of results is related to explicit forward guidance, as adopted by some central banks in the follow-up to the financial crisis. The results show that forward guidance gave rise to less-accurate yield forecasts in Eastern Europe but reduced the heterogeneity of interest rate forecasts in Western countries.

Fourth, our calculation of the optimal transparency level for interest rate forecasts shows that in 2014, 20 central banks had a transparency level corresponding to the optimum, while 30 were above (including 16 euro area countries) and 23 below the optimal level.

We add to the robustness of the evidence by confirming it across a variety of additional analyses, including distinguishing between effects in 3- and 12-month scenarios and between countries with higher and lower transparency levels, the exclusion of all euro area countries but Germany, and alternative measures of uncertainty.

A caveat is in order. Whether more or less communication or whether the degree of transparency should be increased or lowered cannot be definitely answered in our framework. Our paper only studies the effect of communication and transparency on forecast accuracy and dispersion. Although the impact of communication and transparency on this dimension is important, there may be many other beneficial (or harmful) effects of giving public speeches or being transparent on, for instance, accountability, the public's understanding of monetary policy, and trust in the central bank.

The rest of the paper is structured as follows. In **Section 2**, we review the related literature. **Section 3** describes the data underlying the empirical analysis. In **Section 4**, we explain our estimation strategy and present the results. **Section 5** offers a series of robustness checks. **Section 6** discusses possible policy implications. **Section 7** concludes.

2 Literature

There exists a large body of literature on the effects of central bank transparency, communication and optimal central bank design.[2] The empirical evidence suggests overall beneficial effects. One branch of literature analyzes the effect of transparency on the predictability of monetary policy in the financial markets. A number of studies suggest that increased monetary policy transparency may have contributed to an increased ability of financial markets to forecast future monetary policy actions. Most of this research has used information from the Treasury Bill markets, the markets for Federal Funds and Eurodollar futures, and it focuses on a relatively short-run horizon, from one day out to six months.

Three approaches have been pursued. One approach investigates the reaction of market prices to central bank decisions. Little reaction means the decision has been priced in correctly, suggesting high predictability. Evidence has been reported on this topic (see, for instance, Ranaldo & Rossi (2010) and Wilhelmsen & Zaghini (2011)). The second approach is based on the accuracy of expectations priced into the yield curve or futures. Here, too, findings suggest that transparency leads to improved predictability (for instance, Kuttner (2001), Lange et al. (2003)). The third approach examines forecasts and/or the determinants of disagreement among forecasters. Swanson (2006) finds that with the increased transparency of the Federal Reserve, the private sector forecasts of interest rates have become more precise, both by improving the average quality of forecasts and by reducing their dispersion across forecasters. In line with this, Sellon (2008) finds that more-explicit guidance on interest rates led to an improvement in private sector forecasts.

[2] See Van Der Cruijsen et al. (2010) for an overview of the transparency literature, Blinder et al. (2008) for a survey on communication, Geraats (2006) for an overview of the practice of monetary policy transparency, and Blinder (2004) for central bank design.

The evidence stretches beyond the US. Middeldorp (2011) analyzes the connection between the transparency and predictability of short-term interest rates for 24 countries between 1998 and 2005. Higher transparency lowers the errors private agents make in forecasting short-term interest at the 3-month horizon, and it lowers the standard deviation. Dovern et al. (2012) investigate determinants of disagreement in expectations of seven key economic indicators in the G7 countries from 1989 to 2006. In line with the literature (Mankiw et al. (2003)), the measure of cross-sectional dispersion is the inter-quartile range of forecasts in a given country and month. While disagreement about economic activity intensifies strongly during recessions, disagreement about prices is considerably lower under independence of the central bank.[3] Based also on the inter-quartile range of forecasts, Ehrmann et al. (2012) examine whether transparency and communication have led to more-aligned views in the forecasts of macroeconomic variables in 12 advanced economies from 1990 to 2008. While transparency and communication reduce dispersion among professional forecasts, there is some evidence of diminishing marginal effects of increases in (economic) transparency. Naszodi et al. (2016) expand the analysis of Ehrmann et al. (2012) by enlarging the panel to 26 countries and by assessing both the degree of forecasting disagreement and its accuracy. Their results suggest that transparency results in better forecasts by mitigating uncertainty.

To sum up, the empirical literature provides support for the view that transparency is beneficial in the sense that survey forecasts are more aligned with each other and forecast errors decline. The evidence corroborates the general view that enhancing transparency improves the predictability of central banks.

Theoretical papers reach more a nuanced conclusion. On the one hand, more openness may reduce uncertainty about central banks' intentions and their future actions. On the other hand, by attempting to be as open as possible, they may give the impression that they know more than they do. This is a critical issue if transparency and communication serve as a coordination device among economic agents, thereby generating the possibility that agents rely too much on the utterances of central banks. This is what Morris & Shin (2002) argue can happen. Svensson (2006) disagrees with some of their conclusions. Subsequent

[3] Mankiw et al. (2003) show that a sticky-information model can generate a degree of disagreement among agents.

research could not settle the matter.[4]

Restricting transparency could be worth considering for other reasons. For instance, the seminal paper by Cukierman & Meltzer (1986) argued that ambiguity enables monetary authorities to generate surprise inflation and stimulate economic activity. King (2000) notes that a central bank should be highly transparent about its monetary policy reaction function and its target. Beyond that, it should avoid creating news itself. Too much transparency may be prone to misinterpretation and will translate into less-accurate predictions, as the amount of information that can be digested effectively is limited (Kahneman (2003)).

3 Data

In this section, we describe the comprehensive data base we set up for the panel regressions reported in the next section. We first describe the dependent, then the independent variables. The observations are for a maximum of 73 countries from 1998 to 2014, summing up to 17 years of 204 monthly observations per country and forecast variable. The panel exhibits missing values (unbalanced panel). For a full, detailed account of the variables, we refer to Appendix 1.

3.1 Dependent Variables

The dependent variables are the absolute cross-sectional mean errors and the cross-sectional standard deviations of forecasts made by professional forecasters in predicting two financial variables, namely, short-term interest rates and yields on 10-year government bonds, and two macroeconomic variables, namely, CPI inflation and the growth rates of real GDP in four geographic regions: Asia-Pacific, Eastern Europe, Latin America, and "Western countries" (North America, Western Europe, Israel, Egypt, Nigeria, Saudi Arabia, and South Africa). All data are from *Consensus Economics* and are monthly (mostly).

Each month, the survey participants for a particular country report their forecasts of short-term rates for 3 and 12 months ahead. They also report their view on the yields on their country's 10-year government debt, also 3 and 12 months ahead. Forecasts for CPI inflation and the growth rate of real GDP are also

[4] In another paper (Lustenberger & Rossi (2017)), we test the model by Morris & Shin (2002) on interest-rate and yield forecasts.

reported on a monthly basis but refer to the end of the current year and the following year. Forecasts are provided by non-governmental entities (independent or research institutes affiliated with universities) and economic consulting firms. The majority are financial institutions, varying from domestic and regional commercial banks to global investment banks.

We compare forecasts with realized short-term interest rates and long-term yields, as well as end-of-year consumer price indices (where CPI was not available, we chose the GDP deflator) and growth in real GDP. The data are from Reuters EIKON, Bloomberg, IMF International Financial Statistics and the World Bank data base.

3.2 Independent Variables

All independent variables are observed at a time when the forecasts are published by *Consensus Economics* (on that day or the day before). We call this point in time the "forecast formation date".

Speeches According to Freedman & Laxton (2009), the major mechanism for how a central bank's views can reach the public is through a Monetary Policy Report or Inflation Report. Other communication means are press releases, releases of minutes, and speeches to various audiences (among others). Freedman & Laxton (2009) argue that ideally, all means of central bank communication should complement each other to get their message across most effectively. Otherwise, there is a risk of over-communicating and transmitting different messages through the various channels. However, in previous papers there is no clear distinction between transparency and communication. We fill this gap.

We construct a new comprehensive and explicit measure of communication consisting of central bank speeches. To this end, we compiled a variable made up of central bank speeches as collected by the *Bank for International Settlements* (BIS). For each central bank reporting their speeches to the BIS, we counted the number given in the month preceding the forecast. For this variable, we have observations from 1998 to 2014.

Table 1: Central bank speeches by country from 1998 to 2014

WE (24)			AP (15)			EE (24)			LA (10)		
	#	Mean		#	Mean		#	Mean		#	Mean
USA	1386	6.79	AUS	280	1.37	CZE	35	0.17	ARG	31	0.15
JPN	453	2.22	CHN	93	0.46	HUN	11	0.05	BRA	10	0.05
DEU*	361	1.88	HKG	171	0.84	POL	20	0.10	CHL	73	0.36
FRA*	146	0.76	IND	648	3.18	RUS	3	0.01	MEX	40	0.20
GBR	373	1.83	IDN	36	0.18	TUR	83	0.41	VEN	0	0.00
ITA*	148	0.77	MYS	293	1.44	BGR	12	0.06	COL	5	0.02
CAN	344	1.69	NZL	110	0.54	HRV	4	0.02	PER	0	0.00
NLD*	88	0.46	PHL	204	1.00	EST**	19	0.09	URY	1	0.00
NOR	210	1.03	SGP	148	0.73	LVA**	8	0.04	SLV	0	0.00
ESP*	138	0.72	KOR	59	0.29	LTU**	0	0.00	GTM	1	0.00
SWE	410	2.01	TWN	0	0.00	ROU	24	0.12			
CHE	281	1.38	THA	175	0.86	SVK**	3	0.01			
AUT*	60	0.31	BGD	0	0.00	SVN**	2	0.01			
BEL*	31	0.16	PAK	108	0.53	UKR	0	0.00			
DNK	69	0.34	LKA	57	0.28	ALB	190	0.94			
FIN*	80	0.42				ARM	1	0.00			
GRC**	54	0.26				AZE	0	0.00			
IRL*	126	0.66				BLR	0	0.00			
PRT*	21	0.11				BIH	6	0.03			
EGY	0	0.00				CYP**	3	0.01			
ISR	75	0.37				GEO	0	0.00			
NGA	29	0.14				KAZ	0	0.00			
SAU	28	0.14				MKD	39	0.19			
ZAF	233	1.14				MDA	0	0.00			
ECB*	1386	7.22									
LUX*	37	0.19									
MLT**	19	0.23									

The table shows the total number of speeches (#) and the average number of speeches per month (mean) for a country. WE denotes Western countries, AP Asia-Pacific countries, EE Eastern European countries, and LA Latin American countries. The number of countries in the set is given in parenthesis. The euro was introduced in 1999. The ECB counts speeches given by its Executive Board members. In addition, we count all speeches given by members of the Eurosystem from 1999 onwards, marked with *. Therefore, the total number of speeches used in the variable Speech for AUT, BEL, FIN, FRA, DEU, IRL, ITA, NLD, PRT and ESP is # 2712 (mean 14.26). Countries which entered the Eurosystem after 1999 are marked with **. GRC entered in 2001 (# 2554 and mean 12.52), SVN in 2007 (# 1961 and mean 9.66), CYP in 2008 (# 1780 and mean 8.77), SVK in 2009 (1533 and mean 7.55), EST in 2011 (# 1086 and mean 5.35) and LVA since 2014 (# 287 and mean 1.41). LTU is not member of the Eurosystem in our sample for it joined in 2015. No forecasts for LUX and MLT (which entered the Eurosystem in 2008) are available. We use LUX and MLT for completeness of the total number of speeches in the Eurosystem.

Figure 1: Total speeches per year

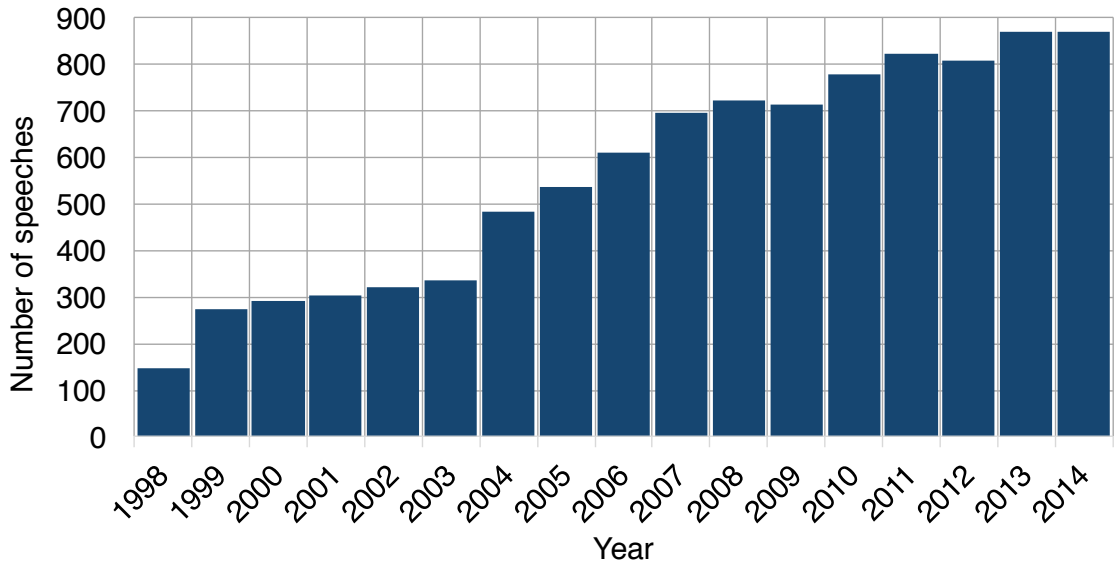


Figure 1 displays the number of speeches given by representatives of central banks per year in the countries included in our sample.

We interpret a speech as a signal sent by the central bank. The theoretical foundation for our interpretation is a Bayesian expectations model shown in Appendix 4 in which more signals are predicted to increase forecast accuracy and reduce forecast dispersion.[5]

Table 1 exhibits the total number of speeches per country and their monthly average divided by four geographic areas. As can be seen, most speeches are given by central banks in Western countries (WE), above all by the Federal Reserve (1,386) and Japan (453). Indian central bankers, grouped with the Asia-Pacific countries (AP), delivered the second-highest number of speeches (648).

Figure 1 illustrates how communication activities by central banks have intensified over time. The number of speeches has steadily increased from approximately 150 in 1998 to nearly 900 in 2013 and 2014. Importantly, this not only reflects more communication activities but also a higher number of central banks reporting their speeches to the BIS.

[5] Note the content of a speech would allude to its precision. Its measure would require a content analysis. A simpler approach about speeches' precision could be its length. It might be that the longer the speech, the more cryptical its information content. However, we refrain from both in this paper and leave them for future research.

There is no potential endogeneity problem associated with our communication measure. Central bank speeches are announced months in advance. Therefore, the number of speeches is fixed, making our communication proxy a well-defined exogenous variable. While the number of speeches is fixed, the content of a speech may take the economic situation into account. In a more uncertain environment, forecasts are likely to be both more inaccurate and more disperse. For this reason, the central bank may want to change the message of a speech. We cannot exclude that some of the speeches were the result of unexpected events that the central bank considered important enough to justify intervention. However, for the bulk of the speeches, this is very unlikely.

Transparency We employ the most comprehensive measure of central bank transparency in terms of country and time coverage based on an extension of the multiple-dimensional transparency index of Eijffinger & Geraats (2006) presented by Dincer & Eichengreen (2014). Their index has annual observations from 1998 to 2010 for 120 central banks.[6] A score for each central bank between zero (minimum transparency) and 15 (maximum transparency) can be obtained. We measure transparency by the updated values of Dincer and Eichengreen, which extends the observations reported in Dincer & Eichengreen (2014) by four more years, until 2014. We utilize the composite index, its five sub-indices, and its fifteen components.

Politico-Institutional Framework of Central Bank Independence We capture the politico-institutional framework at central banks with two different measures suggested by the credibility/transparency literature. The first is actual turnover of the central bank's governor in a year, as described by Dreher et al. (2010). The second variable is central bank independence (CBI), proxied by the unweighted independence index constructed by Dincer & Eichengreen (2014). It runs from 0 (lowest independence) to 1 (highest independence). Both measures include annual observations starting in 1998. While the turnover index covers the full range until 2014, the Dincer-Eichengreen index ends in 2010.

What does the turnover rate stand for in our setup? The literature on central bank independence uses this variable as an indicator for central bank independence, but on average over time. If a central bank has more governors in a given

[6] As documented by Dincer & Eichengreen (2014), central banks in countries with higher per capita income, deeper financial markets, more-open economies, and stronger political institutions are more likely to be more transparent than others.

period, it is presumably less independent. In our application, the interpretation is different. The variable is equal to one when the central bank governor changes. Accordingly, uncertainty about future central bank behavior might easily be greater, leading to more inaccurate and dispersed forecasts. However, this is an effect of uncertainty about the person and is unrelated to the independence of the central bank. If anything, the personality of the governor should be more important in an independent central bank. This implies that in such a central bank, forecast dispersion is more likely than in a central bank where the governor changes but is known to take instructions from the government.[7] Hence, we interpret CBI as a measure of independence and turnover as a measure of (in)stability of central bank management.

Uncertainty Measures We use two uncertainty measures. The first is the VIX (daily) and the second is the macroeconomic uncertainty measure (monthly) by Jurado et al. (2015). The VIX is observed the day before forecasts are made while the macoreconomic uncertainty measure is observed on the day when forecasts are made. Broadly speaking, these variables may also account for the business (interest rate) cycle, which is typically neglected in the related literature. Both variables cover the period 1998 to 2014.

ZLB dummy We created a dummy variable for the period during which the zero lower bound (ZLB) on nominal interest rates was binding. We set the binding constraint at an interest rate level below 0.5%. It is only employed in the regressions of interest rate and yield forecasts.

IT dummy We created a dummy that is equal to one if a central bank pursues an inflation targeting policy, and zero otherwise.

FG dummy We also accounted for central banks pursuing a forward guidance policy. We created a dummy that is equal to one during a period when forward guidance was pursued, and zero otherwise.

Table 2 offers summary statistics for the variables of the benchmark regressions. In the first set, we report the statistics for the absolute forecast errors of the four dependent variables. The absolute cross-sectional mean forecast errors range from zero to a maximum of 237 percent for CPI inflation forecasts. In the second

[7] We thank an anonymous referee for pointing this out to us.

set, we present the corresponding cross-sectional standard deviations, which range from a minimum of zero to a maximum of 108. The third set yields the details of the transparency index. It covers the whole (theoretical) range from zero to 15. In addition to the overall values, we report the values for each of the four geographic areas. The fourth set contains summaries of the other independent variables. The number of speeches (our communication variable) has a mean of 3.5 per month and a maximum of 50. For annual values of turnover of central bank governors, the minimum is zero and the maximum reaches 3. The VIX ranges from a minimum value of 10 to a maximum of 70, with an average of 21. About 30% of our observations are in countries with inflation targeting policies. Around 4% of observations coincide with forward guidance periods.

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Interest Rate (abs FE)	1.093	2.536	0	67.293	11690
Yield (abs FE)	0.652	0.591	0	8.467	7158
CPI (abs FE)	1.656	4.915	0	236.979	24593
Real GDP (abs FE)	1.718	2.046	0	24.112	23459
Interest Rate (Std)	0.520	1.281	0	41.598	11806
Yield (Std)	0.379	0.660	0	15.909	7718
CPI (Std)	0.705	2.050	0	108.383	14906
Real GDP (Std)	0.523	0.410	0.026	8.653	14906
Central Bank Transparency					
Overall	7.7	3.29	0	15	24593
Consensus Economics (WE)	9.4	2.97	1	15	9456
Asian-Pacific (AP)	6.7	3.27	0	14	5757
Eastern Europe (EE)	7.2	3.07	1	14.5	6376
Latin American (LA)	5.9	2.14	1	9	3004
Speech	3.51	7.37	0	50	24593
Turnover	0.16	0.37	0	3	24593
VIX	21.33	9.21	10.02	70.33	24593
ZLB	0.11	0.32	0	1	11686
Inflation Targeting	0.32	0.47	0	1	24593
Forward Guidance	0.04	0.20	0	1	24593

The table provides summary statistics for absolute cross-sectional mean forecast errors (abs FE) and cross-sectional standard deviations (Std) for the two financial (Interest Rates, Yields) and the two macroeconomic variables (CPI Inflation, and Real GDP Growth). The table also exhibits the variation in central bank transparency in the four subsets of geographic regions (Western, Asia-Pacific, Eastern Europe and Latin American countries). Speech is the number of speeches held by central banks per month. Turnover measures replacement of central bank governors. VIX is the Chicago Board Options Exchange Volatility Index. ZLB is a dummy for the zero lower bound. Inflation Targeting is a dummy for inflation targeting policy and Forward Guidance is a dummy for forward guidance as policy instrument.

4 Results

This section is divided into nine subsections. In **Subsection 4.1**, we describe our benchmark model and compare it with previous papers. In **Subsection 4.2**, we elaborate on our benchmark regression results. **Subsection 4.3** extends the analysis to the five different dimensions of the transparency index. **Subsection 4.4** focuses on the results from the subcomponents making up the transparency index. **Subsection 4.5** examines the impact of the level of transparency. In **Subsection 4.6**, we analyze the influence of governor turnover and the degree of central bank independence. **Subsection 4.7** deals with the outcome from an inflation targeting regime. **Subsection 4.8** discusses the effects of forward guidance, and in **Subsection 4.9**, we calculate the optimal degree of transparency for money-market rate forecasts.

4.1 Benchmark Model

We begin with an explanation of our basic fixed-effects regression model. It is given by

$$\begin{aligned} Y_{i,h,t} &= \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{TO} \cdot \text{Turnover}_{i,t} \\ &\quad + \beta_{VIX} \cdot \text{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t} \end{aligned}$$

i is the country, h is the forecast horizon, and t is a monthly time index.

Our left-hand side variable $Y_{i,h,t}$ is either the logarithm of the absolute cross-sectional mean forecast error ($\log[|FE_{i,h,t}|]$) or the logarithm of the cross-sectional standard deviation of forecasts ($\log[\sigma_{i,h,t}]$) provided by *Consensus Economics*. Our forecast variables are the three-month interest rates, ten-year government bond yields, the percent change per annum of the CPI and the growth rate of real GDP.[8]

On the right-hand side, α is the intercept, and ν_i the fixed effect for country i. $\text{Speech}_{i,t}$ captures the number of speeches held by central bank representatives of country i between $t-1$ and t. $\text{Transp.}_{i,t}$ denotes central bank transparency. $\text{Turnover}_{i,t}$ stands for the number of central bank governor turnovers, and VIX_t represents the volatility index. H_h is a horizon fixed effect (dummy for the

[8] Estimates for consumption growth and industrial production growth are available upon request.

forecast horizon), T_y is a yearly fixed effect (dummy to capture a possible time trend), and $ZLB_{i,t}$ is a dummy for the zero lower bound.

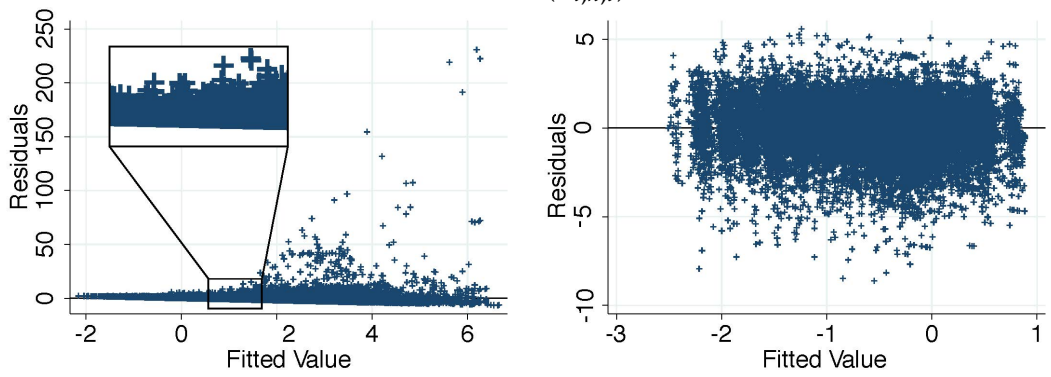
No potential endogeneity arises. All right-hand side variables are taken at the point in time, when a forecast is formed (or the day before). For instance, for the US CPI inflation forecast formed on June 11, 2012 for the end of year CPI inflation, all right-hand side variables are measured on June 11, 2012 (or June 10, 2012). For the number of speeches in June 2012, we counted all speeches held between May 15, 2012 (since the forecast day in the previous month was May 14, 2012), and June 11, 2012. As we described in **Subsection 3.2**, speeches are announced months in advance, making our communication proxy a well-defined exogenous variable. The VIX is taken with its value on June 10, 2012 (the day before the forecast is formed). Hence, while higher uncertainty about stock prices on June 10, 2012 makes forecasts formed on June 11 more uncertain, a reverse effect is not possible. For this reason we do not treat survey dispersion as a measure of uncertainty as is commonly done in the literature. Turnover and transparency are also well-defined exogenous variables. It is highly unlikely that a major change in the management of the central bank, a turnover, materializes because of forecasters' performance. For transparency, it is impossible that one single even extreme forecast error realized in December 2012 motivates a central bank to change its transparency and communication policy in June 2012 (before the forecast error is observed).

Compared to previous research, we introduce three important new variables: The number of speeches, the turnover of the central bank's governor, and the zero-lower-bound constraint. These three variables extend the empirical literature on central bank transparency along three dimensions. First, they allow us to make a clear distinction between transparency and communication; second, to take account of potential implications that uncertainty in a central bank's management can have on forecasts; and third, to consider special constrains on monetary policy which arose due to the financial crisis.[9] **Subsection 4.8** goes even further and extends our benchmark model with a variable for forward guidance.

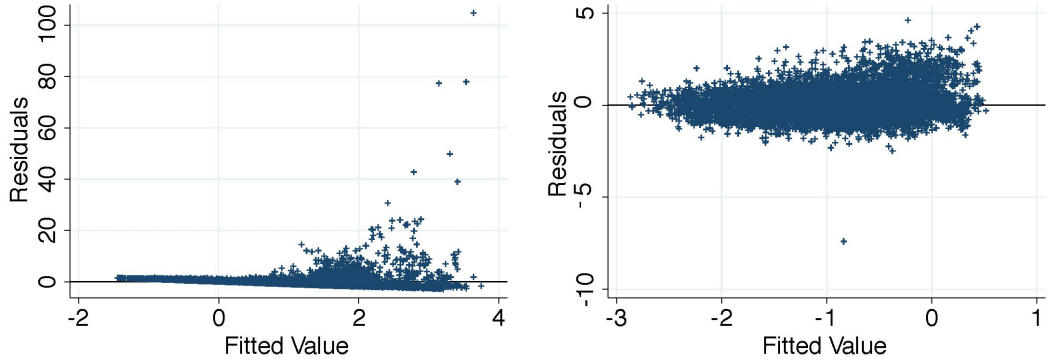
[9] In addition, we employ the VIX instead of GARCH estimates as uncertainty measure.

Figure 2: Plot of residuals on fitted values for country fixed-effects regression models with forecast accuracy and dispersion measures of CPI Inflation

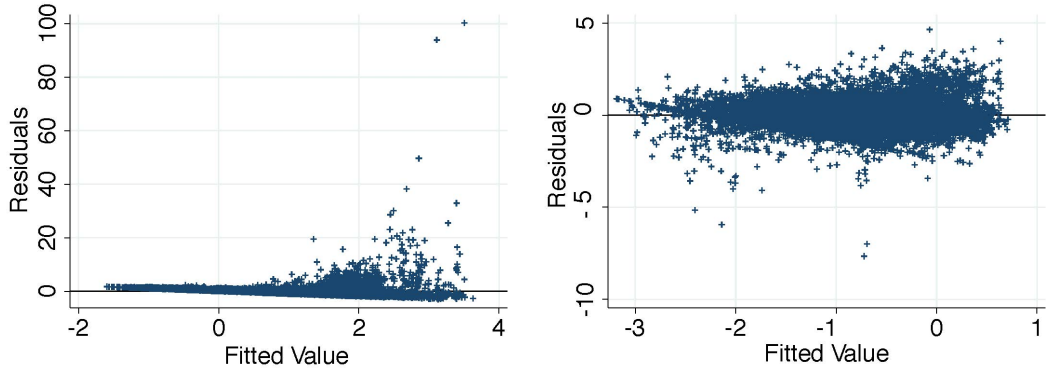
Residuals of regressions with absolute cross-sectional mean forecast error (left) and log of absolute cross-sectional mean forecast error (right) as the dependent variable ($Y_{i,h,t}$)



Residuals with cross-sectional standard deviation (left) and log of cross-sectional standard deviation (right) as dependent variable ($Y_{i,h,t}$)



Residuals with inter-quartile range (left) and log of inter-quartile range (right) as dependent variable ($Y_{i,h,t}$)



Country fixed-effects regression model

$$Y_{i,h,t} = \alpha + \nu_i + \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_{OIL} \cdot |\Delta\text{Oil}_t| + \beta_h \cdot H_h + \beta_T \cdot T_y + + \varepsilon_{i,h,t}$$

For the sake of comparison with Ehrmann et al. (2012) and Naszodi et al. (2016), we add the variation in the absolute value of the oil price to the list of regressors. α is the intercept and ν_i a country fixed effect. $\text{Transp.}_{i,t}$ is the transparency index, $\Delta|\text{Oil}_t|$ is the absolute oil price change, H_h is a dummy for the forecast horizon, and T_y is a dummy for each year.

A fundamental distinction from previous papers arises in the way we calculate the dependent variables, visualized in **Figure 2**. The figure compares the residuals of our model set-up, which are displayed on the right-hand side, with the residuals we obtain from a regression model as typically used in the literature, shown on the left-hand side. The dependent variable is CPI inflation. On the right-hand side of the figure, we plot the residuals obtained from using the logarithm of the dependent variables. On the left-hand side, we show the residuals without the log. We distinguish three measures of the dependent variables. The first is either the absolute forecast error or its log. The results are at the top of the figure. The second is either the cross-sectional standard deviation or its log, with the results plotted in the middle of the figure. The third measure is either the inter-quartile range or its log, shown at the bottom. In the literature following Mankiw et al. (2003), the favorite measure of cross-sectional dispersion is the inter-quartile range of forecasts. Arguably, the advantage of this measure over the simple standard deviation is that it is insensitive to outliers, which might be important in the analysis of survey data.

What **Figure 2** clearly reveals is that the residuals follow a pattern when the dependent variable is not taken in log (left-hand side). Besides heteroskedasticity issues, there is a clear-cut lower bound to the value residuals assume in this setting, as shown by the zoomed window at the top of the figure. Econometric theory tells us that such a regression exhibits inconsistent variance estimates.

We solve these issues. First, we take logs of the dependent variables.[10] As exhibited by **Figure 2** (right-hand side), taking the log of the absolute cross-sectional mean forecast errors and the log of the cross-sectional standard deviation generates well-behaved residuals. Note that, as we observe at the bottom of **Figure 2**, taking the log of the inter-quartile range does not eliminate the "truncated" pattern in the residuals. For this reason, we only use the log of cross-sectional standard deviations of forecasts as a dispersion measure.

Second, we use panel clustered standard errors, where we cluster around countries. Variance estimates using panel clustered standard errors are consistent, as shown by Stock & Watson (2008). The procedure has three advantages: it allows us to get rid of inconsistent variance estimates, to take heteroskedasticity

[10] We are grateful to Massimilano Marcellino for suggesting this data transformation.

into account (only a minor issue)[11], and to correct for correlation in the forecast errors arising from overlapping forecast horizons.

4.2 Benchmark Regression Results

In this subsection, we discuss the results of the benchmark regressions. We pursue a conservative approach and execute two-sided tests for significance of the coefficients.[12] The results are summarized in **Table 3** for absolute forecast errors and **Table 4** for standard deviations.

The findings are sobering. Transparency does not improve the predictability of financial and macroeconomic variables. It does improve the precision of yield forecasts, but only in the subgroup of Western countries. More effective is the influence of greater transparency on forecast dispersion by reducing the misalignment among forecasters of money market rates, 10-year government bond yields and, especially, inflation. Transparency has no effect on GDP growth forecasts.

The main and most important novel contribution to the literature relates to communication, which, as discussed, is measured by the number of central bank speeches. Three results arise. First, communication exerts a much greater influence on private forecast performance than transparency. Second, from **Table 3** and **Table 4**, we can deduce that intensive communication activities make it more difficult to forecast inflation, yields (the latter in contrast to what was found for transparency) and GDP growth, and they increase the dispersion in forecasts of inflation, yields and short-term rates. Third, in terms of statistical significance, the effect of speeches on inflation forecasts is highest. We provide a discussion and interpretation of these results in **Section 6**.

The further analysis sheds light on the effects of politico-institutional aspects of central banks as measured by the turnover rate. The results suggest that

[11] As Santos Silva & Tenreyro (2006) pointed out, heteroskedastic residuals coming from a log-linearized model lead to biased estimates of the true model parameters. However, a visual inspection of **Figure 2** shows that at least the residuals under our log model for absolute forecast errors do not exhibit heteroskedasticity. In the log model for cross-sectional standard deviation, heteroskedasticity cannot be excluded by visual inspection, but seems to be rather a minor issue.

[12] A one-sided test would be appropriate if the estimated value departs from the reference value in only one direction. However, as summarized above, in theory departures are possible in both directions.

instability in the management of central banks (turnover variable) reduces the predictability of future interest rate actions of the central bank and makes the inflation outlook more uncertain. Central bank instability has less of an impact on forecast misalignments, with the exception of yield forecasts, which become less homogeneous. GDP growth forecasts remain unaffected by the turnover rate (similar to transparency).

The VIX plays an important role in most regressions of forecast dispersion. The higher the market uncertainty is, the wider the dispersion becomes. By contrast, market uncertainty has no impact on forecast errors, except for interest rate forecasts, which become more inaccurate.

Another result is that when the zero lower bound is reached, interest rates become easier to predict and their dispersion decreases in Western countries and, especially, in the Asia-Pacific area.

Finally, the fit of the regressions is higher for dispersion as a dependent variable. For this type of regression, the best fit is found for inflation, particularly in Western countries. The best fit for regressions of forecast errors is found for interest rate forecasts in Latin America.

Table 3: Absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.005	0.002	0.005	-0.019	0.033	0.005**	0.005**	-0.049	0.008	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.06)	(0.00)	(0.00)	(0.04)	(0.01)	
Transp.	-0.033	-0.021	-0.125	0.158	-0.100	-0.076*	-0.063***	-0.068	0.046	
	(0.06)	(0.09)	(0.07)	(0.12)	(0.11)	(0.04)	(0.02)	(0.20)	(0.19)	
Turnover	0.203**	-0.045	0.262**	0.637*	0.177	0.025	-0.122	0.233	0.211*	
	(0.08)	(0.10)	(0.11)	(0.25)	(0.10)	(0.08)	(0.08)	(0.12)	(0.08)	
VIX	0.008***	0.009**	0.003	0.009*	0.019*	-0.001	-0.001	0.001	-0.005	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.731***	-0.444**	-1.169***	-0.814*		0.150	0.064		-0.085	
	(0.13)	(0.17)	(0.12)	(0.37)		(0.10)	(0.09)		(0.28)	
N	11686	4761	3977	1407	1541	7155	4755	1604	796	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.27	0.36	0.30	0.29	0.40	0.18	0.23	0.14	0.21	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.020***	0.017**	0.061***	0.009	-0.041	0.010**	0.003	0.042	0.010	-0.001
	(0.00)	(0.01)	(0.02)	(0.01)	(0.11)	(0.00)	(0.01)	(0.03)	(0.01)	(0.06)
Transp.	0.006	0.017	-0.041	0.026	0.118**	0.042	-0.028	0.085	0.056	0.025
	(0.03)	(0.08)	(0.07)	(0.06)	(0.05)	(0.03)	(0.06)	(0.08)	(0.04)	(0.05)
Turnover	0.165**	0.027	0.103	0.028	0.347*	0.063	0.031	0.098	-0.014	0.032
	(0.06)	(0.08)	(0.10)	(0.10)	(0.16)	(0.06)	(0.11)	(0.10)	(0.14)	(0.12)
VIX	-0.000	-0.001	0.001	0.002	-0.005	-0.000	-0.002	0.002	0.002	-0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	24593	9456	5757	6376	3004	23497	9300	5676	5673	2848
Countries	73	24	15	24	10	73	24	15	24	10
R2	0.28	0.28	0.38	0.35	0.21	0.14	0.15	0.16	0.20	0.20

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for the 12-month forecast horizon; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

Table 4: Cross-sectional standard deviation of forecasts

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.007**	0.003	0.024	-0.015	0.133	0.006**	0.006*	-0.014	0.004	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.10)	(0.00)	(0.00)	(0.02)	(0.00)	
Transp.	-0.086**	-0.009	-0.093*	0.079	-0.157	-0.099**	-0.051	-0.130*	-0.008	
	(0.04)	(0.04)	(0.05)	(0.09)	(0.10)	(0.04)	(0.03)	(0.06)	(0.04)	
Turnover	0.126*	0.017	0.031	0.202	0.197*	0.080**	0.040	0.109**	0.012	
	(0.07)	(0.08)	(0.05)	(0.10)	(0.09)	(0.03)	(0.05)	(0.03)	(0.08)	
VIX	0.009***	0.012***	0.005	0.010***	0.014**	0.007***	0.007***	0.010***	0.007	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.279*	-0.333**	-0.588***	0.356		0.131*	0.073		0.261	
	(0.15)	(0.13)	(0.10)	(0.36)		(0.07)	(0.07)		(0.20)	
N	11811	4756	4051	1457	1547	7714	4756	2158	800	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.22	0.37	0.37	0.64	0.12	0.32	0.36	0.40	0.34	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.010***	0.004	0.024	-0.001	0.002	0.002	0.001	0.011	-0.004	-0.071*
	(0.00)	(0.00)	(0.01)	(0.00)	(0.06)	(0.00)	(0.00)	(0.01)	(0.00)	(0.03)
Transp.	-0.112***	-0.007	-0.113	0.012	0.013	-0.020	-0.001	-0.064	0.013	0.001
	(0.04)	(0.05)	(0.06)	(0.04)	(0.08)	(0.02)	(0.02)	(0.05)	(0.03)	(0.06)
Turnover	0.109	-0.053	0.018	-0.010	0.351*	0.055	-0.032	0.034	0.072	0.081
	(0.08)	(0.05)	(0.05)	(0.05)	(0.16)	(0.04)	(0.04)	(0.04)	(0.05)	(0.09)
VIX	0.003***	0.004***	0.003	0.001	0.007***	0.006***	0.004***	0.006***	0.008***	0.007***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	14942	4756	4266	3440	2480	14942	4756	4266	3440	2480
Countries	45	12	12	14	7	45	12	12	14	7
R2	0.46	0.66	0.60	0.63	0.35	0.47	0.58	0.57	0.48	0.46

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The table shows the results for a fixed-effects panel regression of the log of the forecasts' cross-sectional standard deviation. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for the 12-month forecast horizon; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

4.3 Transparency subindices

Neuenkirch (2013) employs the overall transparency index by Eijffinger & Geraats (2006) and the five subindices until 2009 for money market forecasts in 25 emerging market countries. The result is that all subindices improve market expectations, with political transparency having the largest effect.

We replace the overall transparency index by its five subindices as regressors: TI1 Political Transparency, TI2 Economic Transparency, TI3 Procedural Transparency, TI4 Policy Transparency, and TI5 Operational Transparency.[13] The fixed-effects model reads as follows

$$\begin{aligned} Y_{i,h,t} &= \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI1} \cdot \text{TI1}_{i,t} + \cdots + \beta_{TI5} \cdot \text{TI5}_{i,t} \\ &\quad + \beta_{TO} \cdot \text{Turnover}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t} \end{aligned}$$

Appendix 2.1, **Table 7**, summarizes. The results are heterogeneous. At odds with Neuenkirch (2013), we find no evidence of an effect of any transparency subindex. For single geographic areas, the evidence points to a varying impact of the various transparency subindices dependent on the variable under examination.

4.4 Transparency subcomponents

As in Naszodi et al. (2016), we substitute the overall index by breaking it down to its 15 subcomponents (questions).[14] The regression equation looks like

$$\begin{aligned} Y_{i,h,t} &= \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI1a} \cdot \text{TI1a}_{i,t} + \cdots + \beta_{TI5c} \cdot \text{TI5c}_{i,t} \\ &\quad + \beta_{TO} \cdot \text{Turnover}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t} \end{aligned}$$

Appendix 2.2, **Table 8**, presents the results. Overall, no subcomponent provides uniform and broadly based conclusions. Two results are worth highlighting, however. First, question 3c – publication of voting records – results in less-precise interest rate forecasts, especially in Western countries. Second, question 4a – decisions about adjustments to the main operating instrument or target are announced promptly – results in less-precise yield forecasts.

[13] Details of the subindices can be found in Appendix 6.
[14] Appendix 6 provides the details of the index construction.

4.5 Subsample lower and higher transparency (breakpoint 10)

Are there diminishing marginal returns from greater transparency? To answer this question, we compare the results from central banks with a transparency index level below 10 with those having an index value above 10. From the Appendix 2.3, **Table 9**, overall, we find no evidence of diminishing marginal returns from greater transparency.

By contrast, the evidence on communication is more nuanced. More communication at a higher degree of transparency results in higher inaccuracy of yield and, especially, inflation forecasts, echoing the results of the benchmark analysis. However, under lower transparency levels (below 10), intensified communication has hardly any effect on inflation forecasts anymore (expect for the Asian-Pacific area). In fact, more communication even reduces the errors in yield forecasts, the opposite of the benchmark result. In addition, region-specific outcomes related to money-market forecasts are noteworthy. For lower transparency levels, money-market forecasts in the Asian-Pacific area would benefit from greater transparency, whereas the precision of these forecasts would suffer from enhanced transparency in Western countries.

4.6 Turnover/CBI

The benchmark regressions, for which we have transparency values until 2014, are based on the turnover rate as measure for instability within a central bank's management. We noted that a higher turnover rate gives rise to inaccurate interest rate and inflation forecasts and contributes to less homogeneity in yield forecasts.

Are the results affected by replacing the instability variable with a measure of central bank independence (CBI)? To answer this question, we substitute the turnover rate variable for the unweighted CBI index of Dincer & Eichengreen (2014). The results for absolute cross-sectional mean forecast errors are listed in Appendix 2.4, **Table 10**. We infer from the results that a greater CBI worsens the quality of the forecasts of GDP growth and, limited to Western countries, the yield forecasts. Overall, if anything, CBI negatively affects the quality of forecasts. Note that the negative effect of more communication on inflation and GDP growth forecast accuracy found in the benchmark regression (with Turnover instead of CBI) is still observable. We discuss this evidence in **Section 6**.

4.7 Inflation targeting

A monetary policy strategy widely deemed to increase the transparency of policy-making is inflation targeting (IT), and some attention has been devoted to its impact on forecast performance. Cecchetti & Hakkio (2009) estimate how it affects the dispersion of private sector forecasts of inflation. Using a panel data set that includes 15 countries over 20 years, they find no convincing evidence that IT reduces forecast dispersion. The results reported by Crowe (2010) for 11 countries suggest that IT improved the inflation forecasts for those whose initial forecast accuracy was worst without harming the best forecasters.

We add to the evidence by assessing whether and how the introduction of IT has had any repercussion on the quality and standard deviation of forecasts of inflation, interest rates and yields. For this, we added a dummy for the presence of IT to the regressors of the benchmark analysis ($\text{IT}_{i,t}$). The regression equation is

$$\begin{aligned} Y_{i,h,t} &= \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{IT} \cdot \text{IT}_{i,t} \\ &\quad + \beta_{TO} \cdot \text{Turnover}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_H \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t} \end{aligned}$$

As can be seen in **Table 11**, Appendix 2.5, IT tends, overall, to improve the precision of inflation forecasts and reduce the standard deviation of interest rate forecasts. However, it has no effect on the cross-sectional standard deviation of inflation and yield forecasts or any significant impact on the accuracy of interest rate and yield forecasts. More importantly, the results of transparency and speeches on forecast outcomes found in the benchmark regressions does not change.

4.8 Forward Guidance

In this subsection, we examine whether forward guidance has improved the predictability of money-market rates and bond yields. For this purpose, we add a dummy capturing forward guidance ($FG_{i,t}$) to the list of benchmark regressors. The fixed-effects regression model becomes

$$\begin{aligned} Y_{i,h,t} &= \alpha + \nu_i + \beta_{SP} \cdot \text{Speech}_{i,t} + \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{FG} \cdot \text{FG}_{i,t} \\ &\quad + \beta_{TO} \cdot \text{Turnover}_{i,t} + \beta_{VIX} \cdot \text{VIX}_t + \beta_h \cdot H_h + \beta_T \cdot T_y + \beta_{ZLB} \cdot ZLB_{i,t} + \varepsilon_{i,h,t} \end{aligned}$$

As outlined in **Table 12**, Appendix 2.6, forward guidance hardly affected the forecasts of the two financial variables in the whole sample of observations. For Western countries, forward guidance does seem to have lowered the misalignment of interest rate forecasts, but it increased the errors in forecasting yields in Eastern Europe. As in the regressions on IT, the effect of transparency and speeches on forecast outcomes reported in the benchmark regressions does not change.

4.9 Optimal transparency

In **Subsection 4.5**, we noted the importance of the transparency level. In this subsection, we want to go a step further. The results from the communication discussed above suggest that it is public understanding of the significance of released information that is central and not simply the quantity of information. This raises the question of whether there is an optimum to the degree of transparency. The empirical research on this topic has started recently. Ehrmann & Fratzscher (2009) demonstrate that limiting the communication in the week before Federal Open Market Committee meetings is a useful way to prevent market volatility and speculation. Based on a panel data set with the transparency measures provided by Dincer & Eichengreen (2010) from 1998 to 2005, Van Der Cruijsen et al. (2010) find empirical support for an optimal intermediate degree of transparency at which inflation persistence is minimized. Ehrmann et al. (2012) and Neuenkirch (2013) reach a similar verdict.

We contribute to this discussion by calculating the optimal level of transparency for interest rate forecasts. For this purpose, we estimate a fixed-effects panel regression with the absolute forecast errors as the endogenous variable. The regressors are transparency, other controls and a dummy for the forecast horizon.

As can be inferred from **Figure 3**, the relationship between transparency and forecast errors seems to be quadratic. This is why we add transparency squared to the list of regressors. Hence, the regression reads

$$\begin{aligned}\log\left[|FE_{i,h,t}|\right] &= \alpha + \nu_i \underset{(0.11)}{-0.479^{***}} \cdot \text{Transp.}_{i,t} + \underset{(0.01)}{0.027^{***}} \cdot \text{Transp.}^2_{i,t} \\ &\quad + \text{other controls} + \beta_H \cdot H_h + \beta_T \cdot T_y + e_{i,h,t}\end{aligned}$$

"Other controls" include speech, turnover, the VIX, and the dummy for the zero lower bound. H_h is a dummy for the forecast horizon, while T_y is a dummy for each year. Panel clustered standard errors are in parenthesis. A Wald test for the joint hypothesis that transparency and transparency squared are significant leads to a p-value of 0.00 (F-Statistics 10.15 with F(2, 33) degrees of freedom).[15]

Figure 3: Absolute cross-sectional mean forecast errors and transparency for interest rate forecasts

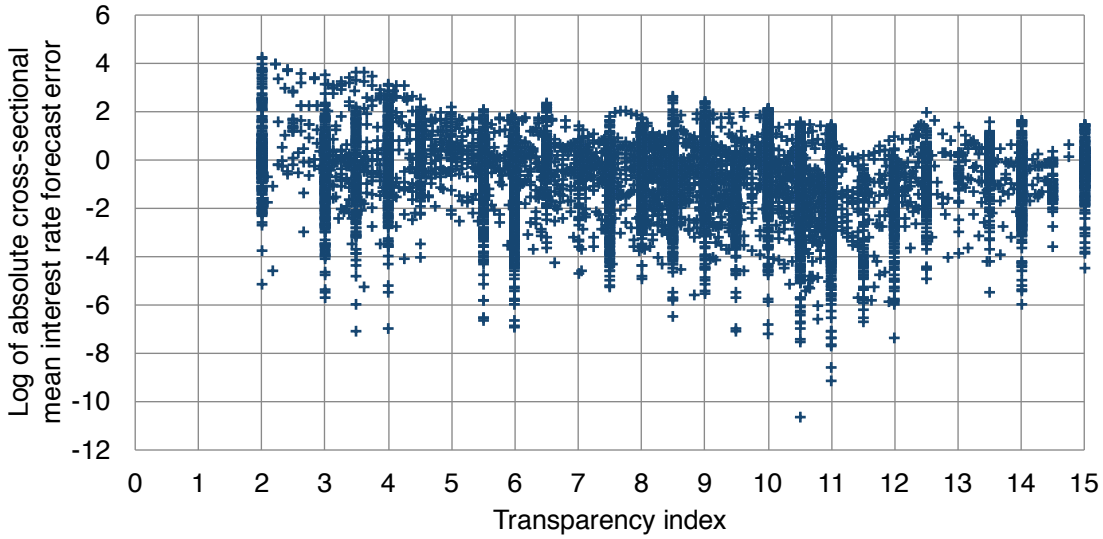


Figure 3 illustrates the log of the absolute cross-sectional mean forecast error for interest rates and transparency level.

The optimal transparency level for interest rate forecasts is 9.01, with a standard deviation equal to 0.78.[16] This gives rise to confidence intervals of $9.01 \pm 1.96 \cdot 0.78 = [7.49; 10.54]$. This result suggests that it is not optimal for a central bank

[15] For yield, CPI inflation, and GDP growth we cannot reject the hypothesis that transparency and transparency squared are jointly zero. In these cases, either a corner solution is optimal or higher polynomials have to be considered in the analysis. This is beyond the scope of this study.

[16] For details of the theoretical derivation, see Appendix 5.

to aspire to the highest transparency level of 15. Nor should its transparency level lie below 7.5 in order to be predictable for money-market participants. For central banks exhibiting a transparency level above 10.5, a cutback in their degree of transparency may have beneficial effects in terms of the predictability of money-market rates. According to the transparency levels reported in **Table 2**, it is mainly Western Economies that have reached the threshold level (9.0). On this account, the Latin American and Asian-Pacific countries – exhibiting mean values around six – are likely to benefit from more transparency of their central banks.

How do our results compare with other research? Neuenkirch (2013) studies how transparency influences money market expectations in 25 emerging markets for the period 1998 to 2009. He reports that an intermediate level of transparency has the most favorable influence on money market expectations. Levels below 7.5 have a negative effect, while levels above seem to be beneficial. During the period 2004-2009, an index of 8 is found to be optimal.

Compared with Van Der Cruijsen et al. (2010), who report an optimum level of 6, our optimality level is clearly higher. Van Der Cruijsen et al. (2010) believe that the actual optimal degree of transparency might be higher, because low degrees of transparency were observed more often. The average degree of transparency in their sample was 4 (compared with 7.7 in our sample), while the maximum was 13.5 (compared with 15 in our sample). In a regression with only OECD countries, they derived an optimal degree of 7.5.

Note that Van Der Cruijsen et al. (2010) calculated optimality levels for inflation forecasts, whereas our estimates relate to optimal transparency for interest rate forecasts. For interest rate forecasts, we reject the joint hypothesis of transparency and transparency squared being zero. For all other variables, the joint hypothesis of transparency and transparency squared being zero is not rejected. This suggests that for interest rate forecasts, transparency has an optimum, whereas for the other variables, no optimal transparency level can be derived from the underlying quadratic function.

While it may be pointless to argue about the precise level of transparency that enables private agents to best predict central bank actions in the future, a comparison of our results with those reported by Van Der Cruijsen et al. (2010) may be

instructive, as they seem to indicate that the optimality level may have increased over the last decade or so. However, we fully agree with Van Der Cruijsen et al. (2010) that the optimum is likely to be central bank-specific and, perhaps, region-specific, given the different information-processing capacities and historical, traditional and cultural backgrounds. The regression analysis reported above does indeed point to distinguished area- (and variable-) specific effects of transparency and communication on private-sector forecasts.

5 Robustness

We redid the estimations with a variety of alternative regressors. In sum, the benchmark results remained valid. We performed the following robustness checks.

Exclusion of the time dummy Excluding the yearly dummy in the benchmark regression leads qualitatively to similar results, but the number of significant coefficients increases dramatically, similar to Naszodi et al. (2016).[17]

Distinction between forecast horizons In Appendix 3.1, **Table 13** and **Table 14**, we report the results for the financial variables distinguished by the two forecast horizons. As can be inferred from **Table 13**, the basic message that transparency in general does not affect the forecast errors is confirmed. Unlike Middeldorp (2011), we find no difference in transparency's effect on predictability between the 3-month and 12-month forecast horizons.[18] The error-increasing effect of communication seems to derive from the 3-month forecast horizon, whereas the error-reducing effect of greater transparency in Western countries appears to stem from the 12-month horizon. As can be seen in **Table 14**, the results for dispersion are similar in both forecast horizons, suggesting that the length of the forecasting horizon is irrelevant for the alignment of forecasts of the two financial variables.

Crisis dummy and subsample analysis We constructed a dummy for the financial crisis, which started in August 2007. The results for both accuracy and dispersion were identical to those of the benchmark model. In addition, we redo

[17] Results are available upon request.

[18] To match the Dincer-Eichengreen data, Middeldorp (2011) utilizes only the survey results for the month closest to the middle of the year, while we use all observations.

our benchmark regressions but limit the observations to the period before the financial crisis (Dec 2006). In general, the results do not change, but are slightly less significant.[19]

Excluding euro area countries So far, we have used all forecasts from the euro area countries. *Consensus Economics* does not collect forecasts for the euro area as a whole, but it does for several constituent countries. To eliminate a potential overweight of the ECB – for instance, we have 17 euro area countries in the calculation of absolute CPI forecast errors – we excluded all euro area countries except for Germany[20] and redid the regression for forecast errors and cross-section standard deviations.

As outlined in Appendix 3.2, **Table 15** and **Table 16**, the benchmark results are confirmed. The only change compared with the benchmark is that transparency has a weaker (alignment-enhancing) impact on the standard deviations of money-market rate and yield forecasts.

Revised GDP figures We found that GDP forecasts react only little to transparency and communication. However, as is well known, GDP figures are regularly revised. To take account of this fact, we used the December GDP forecasts for the current year as the nearest value to the effectively realized GDP and reran the benchmark regression for absolute forecast errors. Overall, the main message concerning communication and transparency remained unchanged.[21]

Uncertainty measure by Jurado et al. (2015) We also checked whether the results remain unaltered if we replaced the VIX with the uncertainty measures from Jurado et al. (2015).

As presented in Appendix 3.3, **Table 17** and **Table 18**, the evidence obtained in the benchmark analysis remains unchanged. Transparency has no effect on forecast precision, but it does reduce forecast dispersion. By contrast, communication worsens the quality of forecasts and increases their dispersion.

[19] Results are available upon request.
[20] For instance, Middeldorp (2011) only used observations from Germany in his analysis.
[21] Only in the Asian Pacific region did the effect of communication change slightly with respect to the benchmark regression. The coefficient remained positive, but became weakly significant. Results are available upon request.

The effect of uncertainty itself on forecast errors is, contrary to the VIX utilized in the benchmark, significant for inflation forecasts. Contrary to the VIX, this uncertainty measure turns out to exert an insignificant effect on the standard deviation of inflation and GDP growth forecasts, for which the VIX yielded highly significant results.[22]

Other institutional variables We also regressed on a series of indicators of good governance and freedom (which exhibit the lowest collinearity issues). Appendix 3.4, **Table 19**, shows the correlation of these indicators with central bank transparency. The benchmark results are also robust to this extension.[23]

Only months with speeches In the benchmark regressions we included observations in the months when actually no speech was delivered. As robustness check, we eliminated these observations from the sample. The general message did not alter.[24]

Exclusion of outliers Finally, we excluded the countries with the largest outliers in terms of forecast errors and took account of the number of forecasters. The results did not change.[25]

6 Policy implications

How do we read the results found in this paper in terms of policy implications? When it comes to transparency, the policy implications are not clear-cut. If the policy objective is to get forecasters to provide more-precise forecasts, our results suggest that transparency is not an adequate tool to achieve it. However, if the objective is to align individual forecasts, then the general normative implication seems to be an increase in transparency.

[22] We also replaced the VIX with the 30-day return volatility of country MSCI stock market indices. Results did not change. They are available upon request.

[23] Results are available upon request.

[24] The coefficient of speech in the benchmark regression with absolute cross-sectional mean forecast errors as the dependent variable turned negative for interest rate forecasts, but was largely insignificant. Results are available upon request.

[25] For CPI inflation forecasts, the largest absolute forecast errors ($>$ 25%-points) are in ARG, BGR, BLR, MDA, RUS, TUR, UKR, and VEN. For interest rate forecasts, the outliers are ARG, IDN, and VEN. Results are available upon request.

One way to interpret the evidence relating to communication is that in order to improve the quality of forecasts of variables that are central to monetary policy-making and align them among professional forecasters, central banks ought to speak less often, especially those that have already achieved a certain degree of transparency.

In general, this normative conclusion can be derived in a Bayesian expectations framework. As we show in Appendix 4, in such a model, our empirical results suggest that more-frequent communication increases the uncertainty of recipients of central bank signals and/or suggests that central banks communicate less precisely.

The important question, then, is whether less-precise communication is an unintended effect of too much talk or whether it is a deliberate choice. The latter is not unrealistic. Indeed, it is probably not always optimal to reduce disagreement across forecasters. There might be circumstances when forecasters underestimate uncertainty, and the central bank may deem it appropriate to remedy this and raise disagreement among forecasters. A case in point is particularly uncertain times, when the central bank may want to convey to the markets an increased uncertainty underlying its own forecasts or to dampen market participants' risk-taking behavior.

However, the second explanation is more realistic, for it is difficult to imagine that a central bank deliberately chooses to keep raising the uncertainty in the markets over time. The reason, as noted by Blinder (2007), is that the policy-effectiveness argument for central bank transparency boils down to teaching the markets to "think like the central bank". Doing so will enable the central bank to manage expectations of future monetary policy better and, in particular, to keep them in line with its own thinking.

In this context, the way central banks reach their decisions is crucial. Blinder (2004) argues that the transformation of monetary policy decisions from individual decisions to group decisions constitutes one of the most notable developments in the recent evolution of central banking. Group decision making is likely to achieve better macroeconomic outcomes than individual decision making for a variety of reasons. First, group decision making provides some insurance against the possibly extreme preferences of an individual. Second, pooling

knowledge in an uncertain world should lead to better analysis and forecasts – and, therefore, to better decisions. Third, a group of people who process information and reach decisions differently may outperform even highly skilled individuals when it comes to the execution of complex tasks. Blinder & Morgan (2005) confirm in an experimental laboratory environment that groups outperform individuals in making monetary policy. However, committee decision making also has its downsides. Sibert (2006) points to the danger of group-think and the tendency of members of a group to free-ride on the efforts of others. Thus, not every group decision is necessarily better than a decision taken by an individual.

According to Blinder (2004), there is no one "right way" to communicate. The most-appropriate forms of central bank communication with the public, the government, and the markets depend on the nature of the monetary policy committee. Blinder (2004) distinguishes individualistic committees and collegial committees. An individualistic committee reaches decisions by true majority vote. Collegial committees come in two forms. Genuinely collegial committees strive for consensus. In an autocratically collegial committee, the chairman comes close to dictating the committee's decision. One potential disadvantage that is particularly relevant for an individualistic committee is that it may confuse outside observers by speaking with too many voices. When too many voices confuse rather than enlighten the markets and the public, transparency turns into noise and degenerate into what Blinder (2004) called cacophony. By contrast, members of a collegial committee agree in advance that their individual differences of opinion must be subordinated to the common good. A collegial committee should be able to speak with one voice most of the time. There should be no (or negligible) public disagreements. Blinder (2007) prefers a monetary policy committee to a single individual, more precisely an individualistic committee structure rather than a collegial one. Members of an individualistic committee have individual accountability, not just group accountability. Acquiring some understanding of the group dynamics should improve market participants' abilities to forecast the committee's future decisions. Moreover, according to Blinder (2007) individualistic committees seem to have coped with their potential cacophony problem.

Or have they? Our dataset does not allow us to differentiate between the different potential types of monetary policy committees along the lines proposed

by Blinder (2004). However, the empirical evidence in this paper suggests that the number of speeches has created confusion rather than clarity. This points to the possibility of (individualistically structured) central banks talking at cross purposes. To corroborate this conjecture, the results obtained from the variables relating to central bank (in)stability and independence may help. As discussed, both a higher turnover rate and a higher CBI index point qualitatively in the same direction. Both suggest a negative effect on the quality of forecasts, although they measure two distinct dimensions of the politico-institutional framework of central banks, mirrored in a correlation coefficient of -0.0026. The evidence seems reasonable for the turnover variable: the more stable the management of the central bank is, the easier it is for market participants to anticipate future policy decisions.

More difficult is rationalizing the evidence associated with the CBI variable. After all, the central bank independence/credibility literature points to increased credibility arising from greater independence with potential favorable knock-on effects on the variance and predictability of variables. However, our CBI variable covers several dimensions of a central bank's structure. One possible dimension is consistent with the observation made by Blinder (2004) that central bank independence promotes the switch to committee decisions rather than individual decisions. This switch may have raised the risk that the central bank speaks with a cacophony of voices.

As an additional corroborating factor for this argumentation, we constructed a variable called committee size that captures the size of monetary policy committees.[26] The correlation of committee size with the number of speeches is +0.74. This suggests that the number of speeches increases in committees' size. Moreover, the correlation of committee size with the CBI variable is +0.51. This is in line with Blinder (2004), who notes that in a number of countries, the movement toward committees went hand-in-glove with the spread of central bank independence. Hence, although causality may run in both directions, these correlations may suggest that the more independent central banks are, the larger the size of the monetary policy committees, and the larger the monetary policy committees are, the more speeches they deliver. This may be one explanation for the rise in the number of speeches over the years that underlie the rise of potential cacophony. We can also give the following interpretation to the evidence of the

[26] See Appendix 1.2.

turnover rate variable: a lower turnover, which reflects a longer effective tenure, could mirror the dominance of an autocratically collegial committee, for which the cacophony problem is less of an issue.

To sum up, we find that the more speeches central banks give, the greater the confusion this creates among forecasters. Whether this arises from too many voices about monetary policy issues or from too many topics not directly related to monetary policy decisions, such as climate change, education, or inequality, is an important avenue for future research.

7 Conclusions

By increasing market participants' ability to predict future policy actions, transparency is expected to increase monetary policy effectiveness. Anticipation of the central bank's actions results in a smoother operation in the first steps of the transmission mechanism between policy actions and economic activity and inflation. The question therefore is: Does central bank communication and transparency affect macroeconomic forecasts at all and in the intended way? We answer this question based on a large sample of countries for financial and macroeconomic variables important for monetary policymaking provided by the private sector.

To answer this question, we adjust the estimation procedure compared with previous studies. We argue that the absolute forecast errors and their standard deviations should be measured in log in order to avoid inconsistent variance estimates.

The answer is only partially affirmative and particularly it is shown that a clear distinction between central bank communication and transparency should be made. Our main finding is that more speeches worsen the accuracy and precision of financial and macroeconomic forecasts. This insight had been anticipated by Simon (1971), for whom "(...) a wealth of information creates a poverty of attention (...)." It also lines up with the conclusions drawn by, for instance, Morris & Shin (2002), Sims (2003), Kahneman (2003) and Blinder (2004), for whom uncoordinated communication might actually lower, rather than raise, the signal-to-noise ratio and, in turn, hamper the operation of monetary policy. Stated differently, a "central bank that speaks with a cacophony of voices may, in effect,

have no voice at all" (Blinder 2004, p. 57). Thus, speaking less may be beneficial for central banks that want to raise predictability and homogeneity among financial and macroeconomic forecasts. We provide some evidence that this may be particularly true for central banks whose transparency level is already high.

Our results also show that we should not expect too much from greater transparency either. We provide compelling evidence that, in general, central bank transparency is not an effective instrument to improve the accuracy of private forecasts. At a more detailed level, our results suggest that it does not constitute a one-size-fits-all model but has effects that vary significantly across countries and variables. Some dimensions, such as the publication of voting records, are even detrimental to the quality of interest rate forecasts.

A forward-guidance policy as pursued after the financial crisis has not borne fruit. It did not affect either the errors or the dispersion of yield forecasts and had only a weak effect on interest rate dispersion. The zero lower bound constraint does notably not affect yield forecasts. Not surprisingly it tends to reduce the forecast errors of interest rates and forecast dispersion.

Overall, the empirical evidence supports the view expressed by Cukierman (2009), who probes the limits of transparency in general. He argues that given the high degree of opacity in the past, it is highly likely that the move of central banks over the last 20 years towards openness to the public has improved matters. However, he also reminds us that since sufficiently high transparency is now in place and is part of the orthodoxy, the time has come to take a more realistic look at the limits of its feasibility and desirability. That said, we also provide evidence that more transparency contributes to aligning single forecasts with each other. From this perspective, transparency seems to provide the anchor by which agents' forecasting actions are coordinated. Thus, what seems to be important in the discussion about more or less central bank transparency is to make a clear distinction between its impact on forecast accuracy and its impact on forecast dispersion.

In a more general context, our results make a contribution to the theoretical literature on the social value of information. The general message arising from our empirical analysis is that more public information may make it more difficult for agents to deduce its content.

We also make a contribution in highlighting the importance of the stability and independence of central banks to the quality of private-sector forecasts. Our finding on this account is that a higher turnover of governors tends to reduce the precision of interest rate and inflation forecasts. Greater central bank independence also tends to worsen the quality of forecasts, perhaps by increasing the size of monetary policy committees that may lead to cacophony. More importantly, the implications of transparency and communication for forecast precision remain broadly unaffected by the choice of an (in)stability proxy or a central bank independence proxy in the regressions.

Future research could track the evolution of committee sizes and analyze the effects per speaker. Another extension could examine the content of speeches along various dimensions, such as their length, comprehensibility and keywords. This would allow to tackle the question whether cacophony arises from too many speeches about all sorts of issues not directly related to monetary policy or from a variety of voices on monetary policy issues.

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Appendix 1 Data sources and construction

Table 5 lists the countries in our sample and their regional classifications as adopted by *Consensus Economics* and the country codes.

Table 5: Consensus Economics data sets and countrycodes

Consensus Forecasts (WE)		Asia Pacific Consensus Forecasts (AP)		Eastern Europe Consensus Forecasts (EE)		Latin American Consensus Forecasts (LA)	
USA	United States of America	AUS	Australia	CZE	Czech Republic	ARG	Argentina
JPN	Japan	CHN	China	HUN	Hungary	BRA	Brazil
DEU	Germany	HKG	Hong Kong	POL	Poland	CHL	Chile
FRA	France	IND	India	RUS	Russia	MEX	Mexico
GBR	United Kingdom	IDN	Indonesia	TUR	Turkey	VEN	Venezuela
ITA	Italy	MYS	Malaysia	BGR	Bulgaria	COL	Colombia
CAN	Canada	NZL	New Zealand	HRV	Croatia	PER	Peru
NLD	Netherlands	PHL	Philippines	EST	Estonia	URY	Uruguay
NOR	Norway	SGP	Singapore	LVA	Latvia	SLV	El Salvador
ESP	Spain	KOR	South Korea	LTU	Lithuania	GTM	Guatemala
SWE	Sweden	TWN	Taiwan	ROU	Romania		
CHE	Switzerland	THA	Thailand	SVK	Slovakia		
AUT	Austria	BGD	Bangladesh	SVN	Slovenia		
BEL	Belgium	PAK	Pakistan	UKR	Ukraine		
DNK	Denmark	LKA	Sri Lanka	ALB	Albania		
FIN	Finland			ARM	Armenia		
GRC	Greece			AZE	Azerbaijan		
IRL	Ireland			BLR	Belarus		
PRT	Portugal			BIH	Bosnia & Herzegovina		
EGY	Egypt			CYP	Cyprus		
ISR	Israel			GEO	Georgia		
NGA	Nigeria			KAZ	Kazakhstan		
SAU	Saudi Arabia			MKD	Macedonia		
ZAF	South Africa			MDA	Moldova		

Appendix 1.1 Dependent variables

Consensus Economics collects monthly financial variables: short-term Interest Rates and long-term Yields three and twelve months into the future. In addition, the survey includes forecasts of macroeconomic forecasts: CPI Inflation and Real GDP Growth for the current and next year. We collected the absolute cross-sectional mean forecast and the cross-sectional standard deviations of forecasts for the four variables from 1998 to 2014 on a monthly basis.

As shown in **Table 5**, *Consensus Economics* groups countries into four sets: *Consensus Forecasts* (WE, mostly Western countries), *Asia Pacific Consensus Forecasts* (AP), *Eastern Europe Consensus Forecasts* (EE), and *Latin American Consensus Forecasts* (LA). *Eastern Europe Consensus Forecasts* was collected by *Consensus Economics* every second month until May 2007 and monthly from then on. *Latin American Consensus Forecasts* has been collected at a monthly frequency since

April 2001. Before then, *Consensus Economics* had collected the forecasts for Latin American countries every second month. The four data sets thus have different publication dates and, consequently, different forecast formation dates. *Consensus Forecasts* and *Asia Pacific Consensus Forecasts* are usually published at the beginning of the month. *Latin American Consensus Forecasts* and *Eastern Europe Consensus Forecasts* follow after some days.

For interest rates and yields, *Consensus Economics* collects forecasts with a 3- and 12-month horizon, leading to two forecasts per month and variable. For each month, there are two standard deviations and mean forecasts per macroeconomic variable: one forecast for the end of the current year and the other forecast for the end of the following year. From 1998 to 2014, there are 204 months. The maximum number of observations possible for cross-sectional standard deviations and mean forecasts is therefore 408.

Absolute mean forecast errors have been calculated by using the realized values from various data sources. Realized Interest Rates and Yields are from *Reuters EIKON* (with one exception from *Bloomberg*). We paid attention to changes in interest rates that are forecast. Tickers are available upon request. The *World Bank* supplies realized CPI Inflation [Inflation, consumer prices (annual %)].[27] Realized Real GDP Growth is from *IMF International Financial Statistics*, called [real GDP growth (annual %)] in their data base.[28] **Table 6** summarizes the observations per country and variable.

Cross-sectional standard deviations of forecasts are calculated by *Consensus Economics*. **Table 6** summarizes the available observations per country and variable.

[27] For BIH, we use [Inflation, GDP deflator (annual %)] from the *World Bank* data base, since [Inflation, consumer prices (annual %)] for BIH is not available. For TWN, we use [Taiwan, CPI Inflation, Price Index] from *Reuters EIKON*, ticker aTWCPI.

[28] For five countries – TWN, ARM, AZE, BIH, and MDA – real GDP was not available in the *IMF* data base. We therefore used the following tickers from *Reuters EIKON*: aTWGDP/C [Taiwan, GDP, Constant Prices], aAMGDPC/C [Armenia, GDP, Constant Prices], aAZGDPC/C [Azerbaijan, GDP, Constant Prices], aBACGDPD/CA [Bosnia and Herzegovina, GDP, Standardized, Constant Prices, SA], aMDCGDPD/CA [Moldova, GDP, Standardized (based on source annual data), Constant Prices, SA] and calculated the corresponding growth rate.

Table 6: Number of observations per country and variable

	CPI Inflation		GDP Growth		Interest Rates		Yields	
	FE	Std	FE	Std	FE	Std	FE	Std
ConsensusForecastsDataSet								
USA	408	408	408	408	408	408	408	408
JPN	408	408	408	408	406	408	408	408
DEU	384	384	384	384	384	384	383	384
FRA	384	384	384	384	384	384	384	384
GBR	408	408	408	408	408	408	408	408
ITA	384	384	384	384	384	384	384	384
CAN	408	408	408	408	407	408	408	408
NLD	384	384	384	384	384	384	384	384
NOR	408	398	408	398	397	398	398	398
ESP	384	384	384	384	384	384	384	384
SWE	408	408	408	408	408	408	408	408
CHE	408	398	408	398	407	398	398	398
AUT	384	0	384	0	0	0	0	0
BEL	384	0	384	0	0	0	0	0
DNK	408	0	408	0	0	0	0	0
FIN	384	0	384	0	0	0	0	0
GRC	336	0	336	0	0	0	0	0
IRL	384	0	384	0	0	0	0	0
PRT	384	0	384	0	0	0	0	0
EGY	408	0	408	0	0	0	0	0
ISR	408	0	408	0	0	0	0	0
NGA	384	0	228	0	0	0	0	0
SAU	408	0	408	0	0	0	0	0
ZAF	408	0	408	0	0	0	0	0
Total	9456	4756	9300	4756	4761	4756	4755	4756
AsiaPacificConsensusForecastsDataSet								
AUS	408	408	408	408	408	408	408	408
CHN	408	408	348	408	260	258	0	0
HKG	408	408	408	408	408	408	0	0
IND	408	408	408	408	381	408	233	408
IDN	408	408	408	408	384	407	227	408
MYS	408	408	408	408	408	408	0	0
NZL	408	408	408	408	408	408	408	408
PHL	405	138	408	138	78	77	0	0
SGP	408	408	396	408	384	408	0	0
KOR	408	408	408	408	408	408	74	74
TWN	48	48	48	48	45	45	29	48
THA	408	408	408	408	405	408	225	404
BGD	408	0	408	0	0	0	0	0
PAK	408	0	408	0	0	0	0	0
LKA	408	0	396	0	0	0	0	0
Total	5757	4266	5676	4266	3977	4051	1604	2158

Continued on next page

Table 6 – continued from previous page

	CPI Inflation		GDP Growth		Interest Rates		Yields	
	FE	Std	FE	Std	FE	Std	FE	Std
EasternEuropeConsensusForecastsDataSet								
CZE	296	292	296	292	292	292	200	200
HUN	296	292	296	292	292	292	200	200
POL	296	292	284	292	292	292	200	200
RUS	296	292	284	292	0	0	0	0
TUR	296	292	296	292	240	289	0	0
BGR	296	184	296	184	0	0	0	0
HRV	292	184	292	184	0	0	0	0
EST	292	184	292	184	0	0	0	0
LVA	292	184	292	184	0	0	0	0
LTU	292	184	292	184	0	0	0	0
ROU	296	292	296	292	0	0	0	0
SVK	296	292	296	292	291	292	196	200
SVN	296	184	296	184	0	0	0	0
UKR	296	292	218	292	0	0	0	0
ALB	184	0	112	0	0	0	0	0
ARM	184	0	36	0	0	0	0	0
AZE	292	0	60	0	0	0	0	0
BLR	292	0	292	0	0	0	0	0
BIH	184	0	156	0	0	0	0	0
CYP	218	0	218	0	0	0	0	0
GEO	184	0	184	0	0	0	0	0
KAZ	280	0	159	0	0	0	0	0
MKD	184	0	184	0	0	0	0	0
MDA	246	0	246	0	0	0	0	0
Total	6376	3440	5673	3440	1407	1457	796	800
LatinAmericanConsensusForecastsDataSet								
ARG	332	368	368	368	330	330	0	0
BRA	368	368	284	368	324	328	0	0
CHL	368	368	368	368	323	325	0	0
MEX	368	368	368	368	330	330	0	0
VEN	272	272	272	272	234	234	0	0
COL	368	368	260	368	0	0	0	0
PER	368	368	368	368	0	0	0	0
URY	272	0	272	0	0	0	0	0
SLV	144	0	144	0	0	0	0	0
GTM	144	0	144	0	0	0	0	0
Total	3004	2480	2848	2480	1541	1547	0	0
Overall	**24593**	**14942**	**23497**	**14942**	**11686**	**11811**	**7155**	**7714**

FE stands for the available number of absolute cross-sectional mean forecast errors while Std is the number of available forecasts' cross-sectional standard deviations.

Appendix 1.2 Independent variables

All independent variables are observed at a time when the forecasts are published by *Consensus Economics*. We call this point in time the "forecast formation date".

Speech is the number of speeches held by representatives of a central bank shown in **Table 1**. We extracted these monthly numbers from the "central bankers' speeches" database of the *Bank for International Settlements* (BIS). Central banks can report speeches they held in English to the BIS. The number of countries reporting to the BIS has increased over time. [29] For each month, we counted all speeches held in the previous month, paying attention to the dates when forecasts were formed. For instance, for WE countries, we counted all speeches between January 12, 1998, and February 9, 1998, for speeches in February 1998. For the beginning of the LA country sample, forecasts are published only every second month. Therefore, we summed all speeches between these forecast dates. For instance, for April 1998, we counted all speeches between February 16, 1998, and April 20, 1998.

The database of the BIS is (probably) not complete and contains only speeches in English. However, it is fair to assume that the most important speeches are included. The central banks for which there is no speech in the BIS database over the whole time span have an entry of zero.

Speeches from the euro area include all speeches of ECB Board members and Presidents of Eurosystem member central banks. In other words, we counted DEU, FRA, ITA, NLD, ESP, AUT, BEL, FIN, IRL and PRT as speeches from the euro area starting in 1999 (start of sample for these countries). In addition, we added to the observations of the euro area the values for GRC from 2001, SVN from 2007, CYP from 2008, SVK from 2009, EST from 2011, and LVA from 2014 on.

[29] The speeches are available under http://www.bis.org/list/cbspeeches/. We thank Bettina Eberhard (BIS), Paul Moser-Boehm (BIS) and Simon Dépraz for their help in collecting these data.

Transp. is the updated version of the transparency index by Dincer & Eichengreen (2014).[30] It runs from 0 to 15 for annual observations from 1998 to 2014. We set the value of the index in June of each year. Then, we interpolated these values over the remaining months. In addition, we enlarged the sample slightly. First, we asked the central bank of TWN for their transparency level, since it is not available in the Dincer-Eichengreen index. TWN assigned itself a level of 11 for both 2013 and 2014. Second, we used the ECB index value for AUT, BEL, DEU, FIN, FRA, IRE, ITA, NLD, PRT and ESP since 1999 (coinciding with the sample start for these countries). We also used the ECB value for countries that entered the euro area. This is the case for GRC since 2001 (Dincer & Eichengreen (2014) do not report an index value for GRC before 2001) and for SVK and SVN since 2007. SVK entered the euro area in 2009. Since the transparency index for SVK stops in 2006, we apply the ECB values for 2007 onwards. We use the ECB index values for CYP from 2008 on and for EST and LVA from 2011. Note that LVA entered the euro area in 2014, but entries for the transparency index stop in 2011. Hence, we use the ECB values from 2011 onwards.

The subindices and the detailed questions underlying the construction of the index are available from 1998 to 2010.[31] We proceeded the same way as described above – June is the index value, while for the other months we interpolated. No subindex is available for TWN. For the details of the index construction, we refer to Appendix 6.

Turnover is the annual turnover rate of central bank governors described by Dreher et al. (2010).[32] We adjusted the data as follows. If there was a turnover, we assigned 1 to all months of the year. If there were two turnovers, all months of this particular year were assigned 2, and so forth. We also enlarged the data sample slightly with values for TWN, MDA, and AZE. For TWN, there is only one change in February 1998.[33] For MDA, there is one change in 2009.[34] For AZE, no change is recorded since 1994.[35] In addition, values for UKR in 1998

[30] We downloaded the updated index from http://eml.berkeley.edu/%7Eeichengr/Dincer-Eichengreen_figures&tables_2014_9-4-15.pdf in February 2017.
[31] The subindices and detailed questions are available under http://eml.berkeley.edu/~eichengr/TI_dincer_eichengreen_2010-1.xlsx, downloaded in February 2017.
[32] We downloaded these data in February 2017 using the link https://www.kof.ethz.ch/services/daten/data-on-central-bank-governors.html.
[33] Source: http://www.cbc.gov.tw/ct.asp?xItem=26314&ctNode=455&mp=2, March 2017.
[34] Source: http://www.bnm.org/en/content/history-nbm, March 2017.
[35] Source: https://en.cbar.az/pages/about-us/organizational-structure/management-board/, March 2017.

and 1999 are missing. However, there was no turnover in 1998 and 1999.[36] We also corrected the data set by Dreher et al. (2010). CAN has an error in 2014. We set the two changes reported by Dreher et al. (2010) to zero since, in fact, no turnover occurred.[37] For members of the euro area, we used the turnover of the president of the ECB. For the countries that entered the euro area after 1999, we used the country turnover by Dreher et al. (2010) until the country entered the euro area. We use the turnover of the president of the ECB from the time when the country entered the monetary union.[38]

VIX is the *Chicago Board Options Exchange volatility index* available from *Reuters EIKON*, ticker CBOEVIX(PI), [CBOE SPX VOLATILITY VIX (NEW) - PRICE INDEX]. We use the VIX observed at the day before each forecasting date. The VIX for a certain month can be different across data sets, since the forecast formation dates might be different. For example, the VIX for WE countries in April 2001 is taken on April 8 (forecasting date April 9), while for LA countries, it is taken on April 22 (forecasting date April 23), 2001.

ZLB dummy is a dummy for the zero lower bound on nominal interest rates. It is one if the short-term interest rate used to calculate the forecast errors is below 0.5% and zero otherwise

CBI is the unweighted central bank independence index by Dincer & Eichengreen (2014). It has annual observations from 1998 to 2010 and goes from zero to one. Zero denotes no independence, one complete independence. We set the index value in June of each year and interpolated over the remaining months. GRC, SVN, CYP and SVK take the ECB values when joining the currency union. For the following countries, there are no observations: CHE, DNK, EGY, HKG, TWN, BGD, PAK, UKR, KAZ, BRA, URY, and GTM.

[36] Source: Tom Warner (2004, October 25). Former banker steeled for Ukraine elections. *The Financial Times*, p. 36, Edition 35,593.
[37] Source: `http://www.bankofcanada.ca/about/history/`, March 2017.
[38] These are GRC in 2001, SVN in 2007, CYP in 2008, SVK in 2009, EST in 2011, and LVA in 2014.

IT We constructed a monthly dummy for inflation targeting (IT) central banks. According to Hammond (2012), there are 24 inflation targeting countries. We added the US from 2012[39] and JPN from 2013[40] to IT countries, which leads to 26 IT central banks in our sample.

FG is a dummy for forward guidance that we set based on Charbonneau & Rennison (2015). Accordingly, the following central banks made use of forward guidance: JPN from April 1999 to July 2000 and from October 2010 to March 2013, the US from December 2008 to December 2014 (end of our sample period), CAN from April 2009 to April 2010, SWE from April 2009 to July 2010 and February 2013 to December 2014, the ECB from July 2013 to December 2014, and GBR from August 2013 to December 2014. All euro area countries are equated with the ECB forward guidance dummy for the corresponding months. LVA is given a value of 1 from January 2014 after joining the currency union.

Uncertainty is a monthly measure of macro uncertainty calculated by Jurado et al. (2015).[41] It covers three uncertainty horizons with a fixed window – 1-month, 3-month and 12-month. For interest rates and yields (financial variables), we picked the 3-month and 12-month macro uncertainty for the corresponding forecast horizons. For the macroeconomic variables, we could only use the 1-month and 3-month forecasts for the current year and the 12-month forecast for the next year to match with the uncertainty measure.

Committee size is the number of members in the monetary policy committee. We use Erhart & Vasquez-Paz (2007) as the source for the *de jure* number of monetary policy committee members as of November 2006.[42] We updated the ECB's governing council by the date when a country joined the euro area. A number of countries are not included in the data set by Erhart & Vasquez-Paz (2007). For these central banks, we use their size as reported on their websites in spring 2017. This is the case for CHN (13), IND (8), TWN (11), THA (7), BGD (9), UKR (6), AZE (5), URY (6), and GTM (6). The monetary policy committee size for HKG and SLV is lacking.

[39] https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20120125.pdf, checked in April 2017.
[40] https://www.boj.or.jp/en/announcements/release_2013/k130122c.pdf, checked in April 2017.
[41] Downloaded under http://www.columbia.edu/~sn2294/pub.html, March 2017.
[42] http://erhartsz.extra.hu/survey.xls, downloaded in April 2017.

Freedom House annually establishes two freedom measures – Political Rights and Civil Liberties.[43] We assigned the values of both indicators to June of each year and interpolated over the remaining months. The indicators are scaled between 1 and 7, where 1 denotes the highest and 7 the lowest degree of freedom. Freedom House reports values for all countries in our sample, except for HKG.

Heritage Foundation annually calculates an overall indicator for economic freedom and its submeasures.[44] For all variables, the corresponding annual values were assumed to prevail in June of each year, followed by interpolation over the remaining months. The Overall Score is the overall measure – the higher the score, the higher the level of freedom (scale 0-100). The submeasures for which we were able to download values are 1) Property Rights, 2) Government Integrity, 3) Tax Burden, 4) Government Spending, 5) Business Freedom, 6) Monetary Freedom, 7) Trade Freedom, 8) Investment Freedom and 9) Financial Freedom, all scaled from 0 to 100. The higher the measure, the higher the level of freedom. The indicators are available for all countries in our sample.

Worldwide Governance Indicators (WGI) provide six measures at yearly frequency for a broader dimension of good governance: 1) Control of Corruption, 2) Government Effectiveness, 3) Political Stability and Absence of Violence/Terrorism, 4) Regulation Quality, 5) Rule of Law, and 6) Voice and Accountability.[45] We again assigned each indicator's annual value to the month of June of the corresponding year and interpolated over the remaining months. Since at the beginning these indicators were published every second year (1997, 1999 and 2001 are missing), we also interpolated over those years. We use the "Estimate" given by WGI as the indicator measure which reaches values from approximately -2.5 (weak) to 2.5 (strong) governance performance. The measures are available for all countries in our sample.

$|\Delta \mathbf{Oil}_t|$ is the absolute oil price change from the previous month, which we employed in the regressions underlying **Figure 2**. We took oil prices from *Reuters EIKON*, ticker OILBRDT [Crude Oil Dated Brent U$/BBL]. The absolute price change is constructed by means of an example for WE countries as follows. In February 1998, we take the price of February 9, 1998 (when the forecast for

[43] Downloaded from https://freedomhouse.org in February 2017.
[44] Index downloaded from http://www.heritage.org in February 2017.
[45] Data downloaded from http://info.worldbank.org/governance/wgi/#home in February 2017.

February 1998 was made), subtract the price of January 12, 1998 (when the January 1998 forecast was made), and calculate the absolute value. For the LA and EE areas, where the frequency of forecasts is every second month at the beginning of the sample, we proceeded as follows, using LA as an example. The LA countries have a forecast made on April 20, 1998. We take the oil price on this day and subtract the oil price of the previous forecast formation date (February 16, 1998) and calculate the absolute value.

Appendix 2 Further results

Appendix 2.1 Subindices

Table 7: Subindices and absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.010**	0.001	0.030	-0.023	0.190	0.003	-0.002	-0.061*	0.022*	
	(0.00)	(0.00)	(0.05)	(0.01)	(0.11)	(0.00)	(0.00)	(0.03)	(0.01)	
Transp.										
political	-0.411	-0.239	-0.532**	-0.478**	-1.009*	0.130	0.207*	-0.530**	-0.852	
	(0.25)	(0.16)	(0.23)	(0.14)	(0.44)	(0.20)	(0.10)	(0.17)	(1.78)	
economic	-0.098	-0.110	-0.151	-0.559*	0.209	-0.145*	-0.143*	-0.263	0.246	
	(0.11)	(0.08)	(0.12)	(0.24)	(0.70)	(0.08)	(0.07)	(0.27)	(0.52)	
procedural	0.066	0.144	0.452	0.480***	-0.733	0.017	-0.101	0.092	-0.606	
	(0.21)	(0.33)	(0.29)	(0.07)	(0.76)	(0.12)	(0.16)	(0.26)	(0.37)	
policy	0.129	0.163	-0.194	0.190	0.022	0.163*	0.198**	1.064*	-0.039	
	(0.15)	(0.24)	(0.22)	(0.16)	(0.49)	(0.08)	(0.09)	(0.39)	(0.13)	
operational	-0.207	0.335	-0.268	1.216**	0.118	-0.342*	-0.281**	-2.389**	-0.695	
	(0.21)	(0.52)	(0.21)	(0.33)	(0.56)	(0.18)	(0.11)	(0.69)	(0.77)	
Turnover	0.135	-0.254	0.234	0.484**	-0.010	-0.008	-0.029	-0.045	0.589**	
	(0.11)	(0.25)	(0.15)	(0.16)	(0.07)	(0.08)	(0.10)	(0.18)	(0.14)	
VIX	0.010***	0.010***	0.006*	0.010	0.020*	-0.002	-0.000	0.001	-0.009	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	
ZLB	-0.073	-0.060	-0.423**			0.127*	0.044			
	(0.11)	(0.17)	(0.16)			(0.06)	(0.04)			
N	8679	3610	2979	928	1162	5038	3603	1023	412	
Countries	33	12	11	5	5	21	12	5	4	
R2	0.22	0.28	0.26	0.31	0.44	0.14	0.18	0.17	0.09	

Continued on next page

Table 7 – continued from previous page

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.024***	0.017**	0.042	0.017**	0.017	0.014***	0.006	0.050	-0.000	-0.038
	(0.01)	(0.01)	(0.03)	(0.01)	(0.14)	(0.01)	(0.01)	(0.05)	(0.01)	(0.10)
Transp.										
political	0.045	-0.338	-0.014	0.691**	0.125	0.185*	0.419**	0.182	-0.034	0.387**
	(0.11)	(0.21)	(0.14)	(0.30)	(0.11)	(0.09)	(0.18)	(0.20)	(0.12)	(0.15)
economic	0.055	-0.016	-0.186	0.334*	0.207	0.121*	0.017	0.081	0.349**	0.160
	(0.10)	(0.20)	(0.18)	(0.17)	(0.21)	(0.07)	(0.13)	(0.22)	(0.16)	(0.11)
procedural	0.039	-0.028	0.249**	-0.121	0.069	0.067	-0.089	0.389**	-0.115	-0.260*
	(0.09)	(0.24)	(0.11)	(0.26)	(0.17)	(0.08)	(0.12)	(0.17)	(0.14)	(0.12)
policy	0.010	0.102	-0.038	-0.159	0.237	-0.013	0.117	-0.126	-0.052	-0.047
	(0.10)	(0.22)	(0.16)	(0.16)	(0.23)	(0.09)	(0.16)	(0.17)	(0.16)	(0.12)
operational	-0.171	-0.110	-0.025	-0.516**	0.020	-0.147	-0.328	-0.176	0.157	-0.310**
	(0.13)	(0.33)	(0.27)	(0.24)	(0.17)	(0.13)	(0.22)	(0.23)	(0.21)	(0.11)
Turnover	0.195**	-0.007	0.043	0.113	0.463**	0.021	-0.016	0.109	0.030	-0.003
	(0.08)	(0.14)	(0.10)	(0.09)	(0.16)	(0.06)	(0.12)	(0.11)	(0.13)	(0.15)
VIX	0.000	-0.000	0.001	0.003	-0.004	-0.001	-0.001	-0.000	0.001	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	17873	7152	4365	4084	2272	17341	7032	4368	3681	2260
Countries	72	24	14	24	10	70	24	14	22	10
R2	0.27	0.27	0.39	0.36	0.18	0.13	0.16	0.12	0.22	0.19

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
The table shows results for a fixed effects panel regression of the log of absolute cross-sectional mean forecast errors for the sub-indices of transparency. We again include a dummy for forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

Appendix 2.2 15 Subcomponents

Table 8: 15 subcomponents and absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.011**	0.002	0.022	-0.012	0.188	0.000	-0.003	-0.055*	0.021*	
	(0.01)	(0.00)	(0.03)	(0.01)	(0.11)	(0.00)	(0.00)	(0.02)	(0.01)	
Transp.										
1a	-0.525	-0.549	-1.209*	-1.028	-3.046*	-0.103	0.127	-0.642	0.352	
	(0.47)	(0.35)	(0.63)	(0.57)	(1.30)	(0.39)	(0.44)	(0.43)	(0.43)	
1b	-0.594	0.353	1.610***	-0.964	-1.695**	0.730**	0.185		0.899***	
	(0.36)	(0.34)	(0.42)	(0.98)	(0.43)	(0.32)	(0.16)		(0.14)	
1c	0.618	-2.191**	0.077			-0.757**	-0.166	-0.452		
	(0.75)	(0.78)	(0.59)			(0.34)	(0.43)	(0.43)		
2a	0.557	-0.396	1.983***	-0.080		-1.124	-0.753	1.586		
	(0.77)	(0.95)	(0.33)	(0.50)		(0.82)	(0.60)	(1.25)		
2b	0.091	0.036	0.085	-0.679		-0.170	-0.115	0.198	0.430	
	(0.18)	(0.17)	(0.16)	(0.35)		(0.14)	(0.14)	(0.57)	(0.35)	
2c	0.078	0.163	-0.744**	1.065**	0.205	-0.101	-0.177	0.266	0.781	
	(0.30)	(0.19)	(0.32)	(0.36)	(0.57)	(0.19)	(0.23)	(0.62)	(0.46)	
3a	-0.151	-0.265	1.727***	0.707*	-0.543	-0.007	-0.052			
	(0.35)	(0.17)	(0.31)	(0.26)	(0.71)	(0.18)	(0.23)			
3b	-0.048		1.200**	-0.344		-0.058		0.456*	-0.714	
	(0.44)		(0.48)	(0.25)		(0.19)		(0.21)	(0.36)	
3c	0.730**	1.684***		0.672**		0.274	0.193		-0.598	
	(0.33)	(0.24)		(0.17)		(0.19)	(0.15)		(0.53)	
4a	0.259		-0.146	0.504	-0.114	1.289***				
	(0.34)		(0.22)	(1.02)	(0.44)	(0.42)				
4b	-0.608	-0.755	-1.044**	0.159	2.139	0.377	0.390	-0.224	-1.025*	
	(0.46)	(0.46)	(0.44)	(0.72)	(1.90)	(0.29)	(0.32)	(0.29)	(0.44)	
4c	0.341	-0.118	-6.857***			-0.047	-0.018	-0.303		
	(0.31)	(0.16)	(1.23)			(0.19)	(0.15)	(0.21)		
5a	0.324	1.282**	6.819***	3.369		-0.056	0.040			
	(0.40)	(0.49)	(1.08)	(1.85)		(0.24)	(0.27)			
5b	-0.500	-0.387	-1.037**	0.528	-0.161	-0.269	-0.353	-5.114**		
	(0.41)	(0.42)	(0.36)	(0.51)	(0.60)	(0.41)	(0.31)	(1.21)		
5c	-0.282		-4.493***		0.937	0.706				
	(0.70)		(0.52)		(1.17)	(1.07)				
Turnover	0.118	-0.144	0.066	0.495**	-0.071	0.014	-0.031	-0.006	0.413**	
	(0.09)	(0.23)	(0.16)	(0.15)	(0.05)	(0.08)	(0.10)	(0.17)	(0.08)	
VIX	0.010***	0.010***	0.006*	0.010	0.020*	-0.002	-0.000	0.001	-0.008	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	
ZLB	-0.098	-0.068	-0.419***			0.112*	0.039			
	(0.07)	(0.18)	(0.13)			(0.05)	(0.04)			
N	8679	3610	2979	928	1162	5038	3603	1023	412	
Countries	33	12	11	5	5	21	12	5	4	
R2	0.23	0.30	0.31	0.35	0.44	0.15	0.18	0.18	0.10	

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Table 8 – continued from previous page

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.024***	0.012*	0.026	0.023**	0.051	0.014***	0.007	0.033	-0.001	-0.005
	(0.01)	(0.01)	(0.02)	(0.01)	(0.11)	(0.00)	(0.01)	(0.03)	(0.00)	(0.08)
Transp.										
1a	0.303	-0.254	-0.615	0.667	-11.016*	-0.549**	0.265	-1.568	-0.763**	-3.191
	(0.34)	(0.57)	(0.59)	(0.48)	(5.53)	(0.27)	(0.30)	(1.11)	(0.32)	(3.53)
1b	0.200	0.029	0.699*	0.666	2.112**	-0.017	0.177	-0.518	0.065	-0.878
	(0.22)	(0.63)	(0.38)	(0.46)	(0.78)	(0.18)	(0.29)	(0.62)	(0.19)	(0.49)
1c	-0.322	-1.520***	0.082	0.158	6.084*	0.650**	1.581***	3.279**	0.294	3.552
	(0.36)	(0.46)	(0.76)	(0.77)	(3.11)	(0.27)	(0.43)	(1.29)	(0.44)	(2.17)
2a	-0.083	0.398	0.803	-0.366	-1.940**	0.137	-1.741***	0.613	0.427	2.424***
	(0.37)	(1.18)	(0.47)	(0.51)	(0.72)	(0.32)	(0.59)	(0.63)	(0.41)	(0.74)
2b	-0.052	-0.210	-0.258	0.379		-0.071	-0.191	0.307	0.063	
	(0.17)	(0.24)	(0.31)	(0.27)		(0.13)	(0.24)	(0.27)	(0.19)	
2c	0.173	0.477	-0.848**	-0.081	0.338	0.250**	0.343*	-0.011	0.482*	0.223
	(0.17)	(0.37)	(0.33)	(0.26)	(0.34)	(0.13)	(0.18)	(0.62)	(0.26)	(0.29)
3a	0.042	0.112	0.082	-0.190	-1.170	0.147	0.247	0.614**	-0.267	-0.356
	(0.16)	(0.36)	(0.20)	(0.32)	(0.68)	(0.14)	(0.22)	(0.23)	(0.24)	(0.46)
3b	-0.231	-0.887***	0.557	-0.699*	1.605	0.095	0.076	0.303	-0.273	0.386
	(0.26)	(0.28)	(0.46)	(0.38)	(1.33)	(0.15)	(0.31)	(0.45)	(0.16)	(0.56)
3c	0.254	0.312	1.365*	1.252**	-1.098	-0.196	-0.166	-0.394	0.401	1.203**
	(0.29)	(0.43)	(0.73)	(0.49)	(0.85)	(0.33)	(0.51)	(1.14)	(0.36)	(0.41)
4a	-0.013	0.066	0.382	-0.316	0.924	-0.035	0.229	0.045	-0.583	-0.640
	(0.22)	(0.39)	(0.43)	(0.37)	(0.59)	(0.16)	(0.25)	(0.46)	(0.37)	(0.49)
4b	-0.033	-0.331	-0.628	0.232	-2.421	-0.190	0.146	-0.367	0.523	-1.141
	(0.37)	(0.54)	(0.92)	(0.42)	(1.37)	(0.27)	(0.46)	(0.68)	(0.37)	(2.22)
4c	0.376	0.236	1.235	-0.531		0.400	0.566	1.837**	-0.352	
	(0.33)	(0.38)	(1.72)	(0.45)		(0.39)	(0.52)	(0.76)	(0.31)	
5a	-0.525*	0.310	0.004	-0.424	-1.019	-0.138	-0.698***	-1.228	0.914**	2.723**
	(0.30)	(0.49)	(1.01)	(0.42)	(1.52)	(0.22)	(0.20)	(0.94)	(0.36)	(0.96)
5b	-0.341	-0.717	-0.357	-0.412	0.271	-0.164	-0.039	0.259	0.093	-0.407
	(0.27)	(0.63)	(0.35)	(0.55)	(1.08)	(0.26)	(0.37)	(0.63)	(0.34)	(0.83)
5c	0.295	0.610	0.216	-0.967	-0.897	-0.297	0.115	-0.320	-0.613	0.004
	(0.37)	(1.07)	(0.31)	(1.01)	(1.37)	(0.35)	(0.35)	(0.68)	(0.75)	(0.64)
Turnover	0.199**	0.054	-0.009	0.079	0.499**	0.021	-0.045	0.093	0.030	0.037
	(0.08)	(0.15)	(0.11)	(0.11)	(0.17)	(0.06)	(0.10)	(0.11)	(0.12)	(0.16)
VIX	0.000	0.000	0.001	0.003	-0.004	-0.001	-0.001	-0.000	0.001	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	17873	7152	4365	4084	2272	17341	7032	4368	3681	2260
Countries	72	24	14	24	10	70	24	14	22	10
R2	0.28	0.29	0.41	0.37	0.21	0.13	0.17	0.13	0.23	0.22

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
The table shows results for a fixed effects panel regression of the log of absolute cross-sectional mean forecast errors for the 15 subcomponents of transparency. We again include a dummy for forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

Appendix 2.3 Subsamples of lower and higher transparency (breakpoint 10)

Table 9: Lower and higher transparency and absolute cross-sectional mean forecast errors (breakpoint 10)

Lower part (Transp. $<$ 10)

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.021	-0.014*	0.012	-0.266***	0.033	-0.030**	-0.021	-0.061***	-0.045***	
	(0.02)	(0.01)	(0.03)	(0.02)	(0.06)	(0.01)	(0.01)	(0.01)	(0.00)	
Transp.	-0.090	0.417**	-0.203**	0.363*	-0.100	0.068	0.127*	-0.086	-0.318	
	(0.08)	(0.15)	(0.06)	(0.13)	(0.11)	(0.10)	(0.06)	(0.25)	(0.24)	
Turnover	0.305***	-0.009	0.344**	0.903**	0.177	0.186	0.126	0.448	0.262	
	(0.08)	(0.19)	(0.14)	(0.28)	(0.10)	(0.13)	(0.11)	(0.21)	(0.18)	
VIX	0.008**	0.002	0.002	0.007	0.019*	0.002	0.015**	-0.006	0.004*	
	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	
ZLB	-0.944***	-0.883***	-1.128***			-0.344*	-0.320			
	(0.10)	(0.24)	(0.16)			(0.17)	(0.27)			
N	6253	1064	3204	444	1541	2083	1056	913	114	
Countries	30	10	10	5	5	17	10	5	2	
R2	0.27	0.21	0.32	0.35	0.40	0.15	0.18	0.20	0.04	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.025*	-0.015*	0.070***	0.008	-0.041	0.021	0.006	0.054	0.008	-0.001
	(0.01)	(0.01)	(0.02)	(0.03)	(0.11)	(0.02)	(0.01)	(0.04)	(0.01)	(0.06)
Transp.	0.063	0.281	-0.073	0.042	0.118**	0.006	0.034	-0.001	0.009	0.025
	(0.05)	(0.17)	(0.08)	(0.09)	(0.05)	(0.04)	(0.13)	(0.08)	(0.04)	(0.05)
Turnover	0.181*	0.021	0.104	0.141	0.347*	0.093	0.058	0.154	0.005	0.032
	(0.09)	(0.13)	(0.09)	(0.12)	(0.16)	(0.06)	(0.19)	(0.10)	(0.14)	(0.12)
VIX	-0.001	-0.008**	0.003	0.001	-0.005	-0.000	-0.002	0.002	0.001	-0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	16299	3584	4837	4874	3004	15215	3428	4756	4183	2848
Countries	68	21	13	24	10	68	21	13	24	10
R2	0.26	0.26	0.39	0.31	0.21	0.13	0.06	0.18	0.23	0.20

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Upper part (**Transp.** ≥ 10)

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.003	0.002	-0.016	-0.009		0.004**	0.004	0.037	0.004	
	(0.00)	(0.00)	(0.01)	(0.01)		(0.00)	(0.00)	(0.02)	(0.01)	
Transp.	0.149	0.256	-0.258	-0.004		-0.099*	-0.099	-0.354***	-0.223	
	(0.09)	(0.14)	(0.13)	(0.19)		(0.05)	(0.09)	(0.01)	(0.36)	
Turnover	-0.019	-0.124	-0.498	0.774*		-0.107	-0.195*	0.234***	0.331**	
	(0.11)	(0.09)	(0.34)	(0.30)		(0.07)	(0.09)	(0.03)	(0.10)	
VIX	0.008***	0.009**	0.003	0.010		-0.002	-0.003	0.011*	-0.007	
	(0.00)	(0.00)	(0.00)	(0.01)		(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.714***	-0.709***	-0.241	-0.863**		0.106	0.133		0.111	
	(0.18)	(0.20)	(0.37)	(0.26)		(0.12)	(0.14)		(0.30)	
N	5433	3697	773	963		5072	3699	691	682	
Countries	22	12	5	5		20	12	4	4	
R2	0.31	0.38	0.36	0.28		0.23	0.26	0.25	0.24	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.012***	0.009**	-0.037	0.006		0.002	0.000	-0.036	-0.005	
	(0.00)	(0.00)	(0.05)	(0.01)		(0.00)	(0.00)	(0.02)	(0.01)	
Transp.	-0.076	-0.018	0.027	-0.339**		-0.002	-0.091	0.098	-0.123	
	(0.09)	(0.15)	(0.16)	(0.14)		(0.06)	(0.08)	(0.34)	(0.19)	
Turnover	0.125	0.182	0.072	0.006		0.052	0.203	-0.303	0.241	
	(0.08)	(0.13)	(0.25)	(0.19)		(0.13)	(0.13)	(0.14)	(0.23)	
VIX	0.002	0.002	-0.009	0.009		-0.001	-0.002	-0.000	0.004	
	(0.00)	(0.00)	(0.01)	(0.01)		(0.00)	(0.00)	(0.00)	(0.00)	
N	8294	5872	920	1502		8282	5872	920	1490	
Countries	33	19	5	9		33	19	5	9	
R2	0.35	0.32	0.41	0.53		0.19	0.23	0.27	0.22	

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). We divide the sample into two parts, one with all transparency values below 10 and the other with all values equal to or above 10. All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. Note that LA has no transparency observations above 10.

Appendix 2.4 CBI

Table 10: CBI by Dincer & Eichengreen (2014) and absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.008	-0.000	0.022	-0.025	0.129	0.001	-0.001	-0.065	0.018***	
	(0.01)	(0.01)	(0.05)	(0.01)	(0.12)	(0.00)	(0.00)	(0.03)	(0.00)	
Transp.	-0.092	0.012	-0.188**	0.282**	-0.234	-0.029	-0.040	0.054	0.102	
	(0.09)	(0.14)	(0.07)	(0.09)	(0.26)	(0.04)	(0.04)	(0.16)	(0.06)	
CBI	1.398*	0.884	-3.624*	-0.097	14.098	0.924*	1.244***	-2.577**	-12.381	
	(0.72)	(0.61)	(1.79)	(2.09)	(10.13)	(0.48)	(0.15)	(0.90)	(6.05)	
VIX	0.010***	0.011**	0.006**	0.012	0.017	-0.001	0.000	0.001	-0.010	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	
ZLB	-0.153	-0.031	-0.466*			0.126*	0.081			
	(0.14)	(0.21)	(0.25)			(0.07)	(0.05)			
N	7609	3299	2599	780	931	4684	3301	1023	360	
Countries	30	11	10	5	4	20	11	5	4	
R2	0.21	0.27	0.23	0.26	0.45	0.13	0.17	0.14	0.08	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.022***	0.021***	0.038	-0.010	-0.075	0.013**	0.003	0.036	0.002	-0.059
	(0.01)	(0.01)	(0.03)	(0.01)	(0.16)	(0.01)	(0.01)	(0.05)	(0.00)	(0.12)
Transp.	-0.058	-0.033	-0.020	0.004	-0.175	-0.006	0.056	0.015	0.006	-0.139
	(0.05)	(0.09)	(0.09)	(0.08)	(0.26)	(0.04)	(0.08)	(0.11)	(0.04)	(0.15)
CBI	0.061	0.287	-0.462	0.321	0.000	1.748***	0.805**	2.505	1.617**	2.008***
	(0.67)	(0.90)	(1.44)	(1.39)	(0.95)	(0.42)	(0.31)	(2.92)	(0.63)	(0.44)
VIX	0.001	-0.000	0.002	0.005	-0.003	-0.001	-0.001	-0.000	0.001	-0.004
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	14583	6216	3361	3326	1680	14130	6096	3364	3002	1668
Countries	61	21	11	22	7	59	21	11	20	7
R2	0.27	0.28	0.40	0.34	0.14	0.14	0.18	0.11	0.21	0.23

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The table shows results for a fixed effects-panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months) while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. Turnover is replaced by the central bank independence index (CBI) of Dincer & Eichengreen (2014).

Appendix 2.5 Inflation targeting

Table 11: Inflation targeting

CPI Inflation

	Absolute cross-sectional mean forecast error					Cross-sectional standard deviation				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.018***	0.017**	0.062***	0.005	-0.046	0.008**	0.004	0.022	-0.004	-0.003
	(0.00)	(0.01)	(0.02)	(0.01)	(0.12)	(0.00)	(0.00)	(0.01)	(0.00)	(0.07)
Transp.	0.031	0.019	0.081	0.062	0.131**	-0.091**	-0.015	-0.042	0.035	0.012
	(0.03)	(0.09)	(0.07)	(0.06)	(0.05)	(0.04)	(0.05)	(0.06)	(0.04)	(0.09)
IT	-0.436**	-0.032	-0.858***	-0.620	-0.774***	-0.311	0.094	-0.443***	-0.634**	-0.570
	(0.18)	(0.14)	(0.24)	(0.37)	(0.18)	(0.19)	(0.20)	(0.11)	(0.26)	(0.37)
Turnover	0.161**	0.026	0.091	0.036	0.322*	0.109	-0.050	0.026	0.004	0.325*
	(0.07)	(0.08)	(0.10)	(0.10)	(0.16)	(0.08)	(0.05)	(0.04)	(0.05)	(0.15)
VIX	-0.000	-0.001	0.001	0.002	-0.005	0.003***	0.004***	0.003	0.001	0.006***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	24593	9456	5757	6376	3004	14942	4756	4266	3440	2480
Countries	73	24	15	24	10	45	12	12	14	7
R2	0.28	0.28	0.38	0.35	0.22	0.47	0.66	0.61	0.66	0.37

Interest Rates

	Absolute cross-sectional mean forecast error					Cross-sectional standard deviation				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.004	0.002	0.000	-0.016	0.033	0.006	0.002	0.020	-0.016	0.133
	(0.00)	(0.00)	(0.02)	(0.01)	(0.06)	(0.00)	(0.00)	(0.01)	(0.01)	(0.10)
Transp.	-0.007	0.002	0.003	0.134	-0.100	-0.049	0.012	0.026	0.096	-0.157
	(0.06)	(0.10)	(0.08)	(0.10)	(0.11)	(0.04)	(0.04)	(0.06)	(0.08)	(0.10)
IT	-0.353	-0.287	-0.809**	0.642*		-0.478**	-0.252	-0.740**	-0.531	
	(0.24)	(0.34)	(0.32)	(0.28)		(0.19)	(0.16)	(0.25)	(0.31)	
Turnover	0.206**	-0.056	0.277**	0.612*	0.177	0.129	0.008	0.041	0.214	0.197*
	(0.09)	(0.11)	(0.12)	(0.24)	(0.10)	(0.08)	(0.08)	(0.05)	(0.10)	(0.09)
VIX	0.008***	0.009**	0.003	0.009*	0.019*	0.009***	0.012***	0.005	0.010***	0.014**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ZLB	-0.729***	-0.446**	-1.186***	-0.756		-0.291**	-0.335**	-0.605***	0.198	
	(0.13)	(0.16)	(0.12)	(0.38)		(0.13)	(0.12)	(0.09)	(0.32)	
N	11686	4761	3977	1407	1541	11811	4756	4051	1457	1547
Countries	34	12	12	5	5	34	12	12	5	5
R2	0.27	0.36	0.30	0.30	0.40	0.23	0.37	0.38	0.65	0.12

Continued on next page

Table 11 – continued from previous page

Yields

	Absolute cross-sectional mean forecast error					Cross-sectional standard deviation				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.004	0.005**	-0.048	0.008	0.005**	0.006*	-0.018	0.004		
	(0.00)	(0.00)	(0.04)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)		
Transp.	-0.007	-0.058**	-0.068	0.046	-0.056*	-0.043	-0.011	-0.008		
	(0.06)	(0.03)	(0.20)	(0.19)	(0.03)	(0.03)	(0.06)	(0.04)		
IT	-0.353	-0.059	0.552		-0.366**	-0.099	-0.653***			
	(0.24)	(0.29)	(0.41)		(0.17)	(0.10)	(0.05)			
Turnover	0.206**	-0.124	0.231	0.211*	0.079**	0.036	0.141**	0.012		
	(0.09)	(0.08)	(0.12)	(0.08)	(0.03)	(0.05)	(0.04)	(0.08)		
VIX	0.008***	-0.001	0.001	-0.005	0.007***	0.007***	0.009***	0.007		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
ZLB	-0.729***	0.063		-0.085	0.140**	0.072		0.261		
	(0.13)	(0.09)		(0.28)	(0.07)	(0.07)		(0.20)		
N	11686	4755	1604	796	7714	4756	2158	800		
Countries	34	12	7	4	23	12	7	4		
R2	0.27	0.23	0.14	0.21	0.33	0.36	0.43	0.34		

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
The table shows results for a fixed effects-panel regression of the log of forecasts' cross-sectional absolute mean error and standard deviation. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; CPI Inflation has a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. IT is the inflation targeting dummy.

Appendix 2.6 Forward guidance

Table 12: Forward Guidance - Absolute cross-sectional mean forecast errors and forecasts' cross-sectional standard deviation

Absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.005	0.002	0.005	-0.022*	0.033	0.005*	0.005**	-0.049	0.005	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.06)	(0.00)	(0.00)	(0.04)	(0.01)	
Transp.	-0.032	-0.020	-0.125	0.158	-0.100	-0.072*	-0.061***	-0.068	0.063	
	(0.06)	(0.09)	(0.07)	(0.12)	(0.11)	(0.04)	(0.02)	(0.20)	(0.18)	
FG	0.121	0.057		0.346		0.160	0.106		0.399**	
	(0.18)	(0.20)		(0.44)		(0.09)	(0.07)		(0.07)	
Turnover	0.205**	-0.043	0.262**	0.639*	0.177	0.028	-0.118	0.233	0.220*	
	(0.08)	(0.10)	(0.11)	(0.25)	(0.10)	(0.08)	(0.08)	(0.12)	(0.09)	
VIX	0.008***	0.009**	0.003	0.009*	0.019*	-0.001	-0.001	0.001	-0.006	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.772***	-0.466**	-1.169***	-0.890		0.084	0.023		-0.169	
	(0.16)	(0.21)	(0.12)	(0.53)		(0.09)	(0.09)		(0.24)	
N	11686	4761	3977	1407	1541	7155	4755	1604	796	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.27	0.36	0.30	0.29	0.40	0.18	0.23	0.14	0.22	

Forecasts' cross-sectional standard deviation

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.009**	0.003	0.024	-0.011*	0.133	0.006**	0.006*	-0.014	0.002	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.10)	(0.00)	(0.00)	(0.02)	(0.00)	
Transp.	-0.086**	-0.012	-0.093*	0.078	-0.157	-0.099**	-0.052	-0.130*	-0.000	
	(0.04)	(0.05)	(0.05)	(0.09)	(0.10)	(0.04)	(0.03)	(0.06)	(0.05)	
FG	-0.228*	-0.258**		-0.398		-0.038	-0.029		0.215	
	(0.13)	(0.10)		(0.40)		(0.05)	(0.05)		(0.14)	
Turnover	0.122	0.008	0.031	0.198	0.197*	0.079**	0.039	0.109**	0.017	
	(0.07)	(0.07)	(0.05)	(0.10)	(0.09)	(0.03)	(0.05)	(0.03)	(0.08)	
VIX	0.009***	0.012***	0.005	0.010***	0.014**	0.007***	0.007***	0.010***	0.007	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.208	-0.235*	-0.588***	0.406		0.147**	0.084		0.216	
	(0.17)	(0.12)	(0.10)	(0.41)		(0.07)	(0.09)		(0.19)	
N	11811	4756	4051	1457	1547	7714	4756	2158	800	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.23	0.38	0.37	0.64	0.12	0.32	0.36	0.40	0.35	

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months). We include a dummy for the 12-month forecast horizon. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. FG is a dummy for forward guidance.

Appendix 3 Robustness

Appendix 3.1 Absolute forecast errors with 3-month and 12-month forecast horizons

Table 13: Absolute cross-sectional mean forecast errors of separate forecast horizons (3- and 12-month)

	3-month forecast horizon									
	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.008*	0.006	0.027	-0.024	0.154	0.006	0.007*	-0.054	-0.004	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.09)	(0.00)	(0.00)	(0.05)	(0.01)	
Transp.	-0.044	-0.026	-0.152**	0.085	-0.141	-0.051	-0.036	-0.090	0.001	
	(0.06)	(0.10)	(0.06)	(0.14)	(0.09)	(0.04)	(0.03)	(0.21)	(0.23)	
Turnover	0.126	-0.191	0.261**	0.684**	0.051	0.032	-0.119	0.317*	0.300***	
	(0.10)	(0.14)	(0.09)	(0.23)	(0.11)	(0.09)	(0.10)	(0.15)	(0.03)	
VIX	0.015***	0.017***	0.013**	0.016	0.016	0.011***	0.010**	0.012*	0.013	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.00)	(0.00)	(0.01)	(0.01)	
ZLB	-0.723***	-0.414*	-1.211***	-0.460		0.068	0.028		-0.299	
	(0.16)	(0.19)	(0.18)	(0.51)		(0.11)	(0.11)		(0.35)	
N	5828	2379	1981	703	765	3565	2377	792	396	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.21	0.32	0.27	0.22	0.29	0.07	0.10	0.10	0.19	

	12-month forecast horizon									
	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.002	-0.001	-0.015	-0.013	-0.082*	0.004	0.002	-0.044	0.018	
	(0.00)	(0.00)	(0.03)	(0.01)	(0.03)	(0.00)	(0.00)	(0.03)	(0.01)	
Transp.	-0.021	-0.015	-0.098	0.230	-0.061	-0.103*	-0.089***	-0.052	0.043	
	(0.06)	(0.09)	(0.10)	(0.12)	(0.14)	(0.05)	(0.02)	(0.22)	(0.24)	
Turnover	0.281***	0.100	0.266	0.590	0.301*	0.016	-0.125	0.144	0.120	
	(0.09)	(0.12)	(0.16)	(0.32)	(0.13)	(0.10)	(0.11)	(0.11)	(0.14)	
VIX	0.001	0.001	-0.007	0.002	0.021***	-0.013***	-0.012***	-0.010	-0.024	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	
ZLB	-0.736***	-0.473**	-1.121***	-1.166**		0.233*	0.099		0.117	
	(0.12)	(0.16)	(0.21)	(0.31)		(0.12)	(0.10)		(0.24)	
N	5858	2382	1996	704	776	3590	2378	812	400	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.23	0.35	0.23	0.29	0.36	0.19	0.27	0.10	0.26	

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months). We include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

Table 14: Cross-sectional standard deviation of separate forecast horizons (3- and 12-month)

	3-month forecast horizon									
	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.013***	0.008**	0.037*	-0.014	0.269	0.007**	0.008*	-0.015	0.004	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.17)	(0.00)	(0.00)	(0.02)	(0.00)	
Transp.	-0.090*	-0.016	-0.087	0.042	-0.272	-0.107**	-0.043	-0.147*	-0.082	
	(0.05)	(0.06)	(0.06)	(0.10)	(0.16)	(0.05)	(0.04)	(0.07)	(0.05)	
Turnover	0.165**	0.089	0.040	0.186	0.218*	0.104**	0.071	0.137***	-0.036	
	(0.08)	(0.11)	(0.05)	(0.14)	(0.09)	(0.04)	(0.06)	(0.03)	(0.07)	
VIX	0.014***	0.018***	0.006	0.013***	0.022**	0.010***	0.009***	0.012***	0.009	
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.349*	-0.410**	-0.778***	0.338		0.118	0.049		0.220	
	(0.18)	(0.16)	(0.18)	(0.42)		(0.07)	(0.08)		(0.18)	
N	5895	2378	2020	727	770	3855	2378	1077	400	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.12	0.19	0.26	0.55	0.09	0.20	0.20	0.31	0.27	

	12-month forecast horizon									
	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.002	-0.002	0.012	-0.016*	0.004	0.005**	0.004*	-0.012	0.004**	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.08)	(0.00)	(0.00)	(0.02)	(0.00)	
Transp.	-0.082**	-0.001	-0.099*	0.116	-0.041	-0.091**	-0.059*	-0.113*	0.065	
	(0.04)	(0.04)	(0.05)	(0.07)	(0.07)	(0.04)	(0.03)	(0.05)	(0.04)	
Turnover	0.087	-0.055	0.021	0.218**	0.177	0.056*	0.009	0.080*	0.060	
	(0.07)	(0.06)	(0.05)	(0.07)	(0.11)	(0.03)	(0.06)	(0.04)	(0.09)	
VIX	0.005***	0.006***	0.004*	0.007*	0.006	0.005***	0.004***	0.007***	0.005	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.207	-0.257**	-0.392***	0.375		0.144*	0.097		0.303	
	(0.13)	(0.10)	(0.09)	(0.30)		(0.07)	(0.08)		(0.23)	
N	5916	2378	2031	730	777	3859	2378	1081	400	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.34	0.39	0.46	0.65	0.43	0.17	0.15	0.34	0.25	

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed-effects panel regression of the log of forecasts' cross-sectional standard deviation. Interest Rates and Yields have two forecast horizons (3 and 12 months). We include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries.

Appendix 3.2 Exclude euro area countries except Germany

Table 15: Absolute cross-sectional mean forecast errors excluding euro area

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.006	-0.001	0.005	-0.071	0.033	0.003	0.007*	-0.049	-0.059	
	(0.01)	(0.01)	(0.02)	(0.06)	(0.06)	(0.01)	(0.00)	(0.04)	(0.03)	
Transp.	-0.006	0.008	-0.125	0.261**	-0.100	-0.064	-0.069***	-0.068	0.303**	
	(0.07)	(0.08)	(0.07)	(0.08)	(0.11)	(0.04)	(0.02)	(0.20)	(0.06)	
Turnover	0.216**	0.022	0.262**	0.294	0.177	0.056	-0.053	0.233	0.114	
	(0.09)	(0.11)	(0.11)	(0.16)	(0.10)	(0.08)	(0.06)	(0.12)	(0.14)	
VIX	0.006**	0.004	0.003	0.008	0.019*	-0.000	0.000	0.001	-0.007	
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	
ZLB	-0.639***	-0.351*	-1.169***	-0.387*		0.033	-0.037		-0.325	
	(0.14)	(0.15)	(0.12)	(0.15)		(0.08)	(0.09)		(0.17)	
N	9859	3225	3977	1116	1541	5423	3219	1604	600	
Countries	29	8	12	4	5	18	8	7	3	
R2	0.26	0.34	0.30	0.25	0.40	0.17	0.25	0.14	0.20	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.027***	0.017**	0.061***	-0.085	-0.041	0.013	0.004	0.042	0.011	-0.001
	(0.01)	(0.01)	(0.02)	(0.09)	(0.11)	(0.01)	(0.01)	(0.03)	(0.05)	(0.06)
Transp.	0.044	0.070	-0.041	0.079	0.118**	0.048	-0.007	0.085	0.070	0.025
	(0.04)	(0.08)	(0.07)	(0.07)	(0.05)	(0.03)	(0.06)	(0.08)	(0.06)	(0.05)
Turnover	0.205***	0.078	0.103	0.117	0.347*	0.068	0.048	0.098	-0.025	0.032
	(0.08)	(0.09)	(0.10)	(0.12)	(0.16)	(0.06)	(0.11)	(0.10)	(0.16)	(0.12)
VIX	-0.000	-0.001	0.001	0.003	-0.005	-0.000	-0.002	0.002	0.001	-0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	19499	6048	5757	4690	3004	18403	5892	5676	3987	2848
Countries	58	15	15	18	10	58	15	15	18	10
R2	0.26	0.24	0.38	0.33	0.21	0.13	0.12	0.16	0.20	0.20

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed-effects panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. We exclude all euro area countries except DEU (euro area countries are in WE and EE).

Table 16: Forecasts' cross-sectional standard deviation excluding euro area

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.014**	0.005	0.024	-0.052	0.133	-0.001	0.001	-0.014	0.023	
	(0.01)	(0.00)	(0.02)	(0.04)	(0.10)	(0.00)	(0.00)	(0.02)	(0.07)	
Transp.	-0.087*	-0.001	-0.093*	0.024	-0.157	-0.090*	-0.030	-0.130*	0.029	
	(0.05)	(0.05)	(0.05)	(0.09)	(0.10)	(0.05)	(0.03)	(0.06)	(0.06)	
Turnover	0.108	-0.034	0.031	0.124	0.197*	0.080**	0.032	0.109**	0.101	
	(0.08)	(0.06)	(0.05)	(0.06)	(0.09)	(0.03)	(0.05)	(0.03)	(0.07)	
VIX	0.008***	0.010***	0.005	0.008***	0.014**	0.007***	0.006***	0.010***	0.005	
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
ZLB	-0.296	-0.407**	-0.588***	0.432		0.099	0.059		0.005	
	(0.18)	(0.14)	(0.10)	(0.52)		(0.07)	(0.09)		(0.12)	
N	9983	3220	4051	1165	1547	5978	3220	2158	600	
Countries	29	8	12	4	5	18	8	7	3	
R2	0.21	0.33	0.37	0.63	0.12	0.34	0.41	0.40	0.37	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.010***	-0.003	0.024	-0.025	0.002	0.002	-0.001	0.011	-0.031	-0.071*
	(0.00)	(0.00)	(0.01)	(0.04)	(0.06)	(0.00)	(0.00)	(0.01)	(0.02)	(0.03)
Transp.	-0.112***	-0.001	-0.113	0.031	0.013	-0.017	0.003	-0.064	0.015	0.001
	(0.04)	(0.06)	(0.06)	(0.06)	(0.08)	(0.03)	(0.03)	(0.05)	(0.02)	(0.06)
Turnover	0.109	-0.019	0.018	-0.079*	0.351*	0.060	-0.006	0.034	0.039	0.081
	(0.08)	(0.05)	(0.05)	(0.04)	(0.16)	(0.04)	(0.05)	(0.04)	(0.05)	(0.09)
VIX	0.003***	0.004***	0.003	0.001	0.007***	0.007***	0.005**	0.006***	0.009***	0.007***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	14942	3220	4266	2412	2480	12378	3220	4266	2412	2480
Countries	45	8	12	9	7	36	8	12	9	7
R2	0.46	0.69	0.60	0.64	0.35	0.47	0.56	0.57	0.50	0.46

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed-effects panel regression of the log of forecasts' cross-sectional standard deviation. Interest Rates and Yields have two forecast horizons (3 and 12 months) while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. We exclude all euro area countries except DEU (euro area countries are in WE and EE).

Appendix 3.3 Jurado et al. (2015) macroeconomic uncertainty measure

Table 17: Macro uncertainty Jurado et al. (2015) and absolute cross-sectional mean forecast errors

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.006	0.003	0.006	-0.018	0.034	0.005**	0.005**	-0.048	0.008	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.05)	(0.00)	(0.00)	(0.04)	(0.01)	
Transp.	-0.033	-0.022	-0.125*	0.156	-0.097	-0.076*	-0.063***	-0.071	0.033	
	(0.06)	(0.09)	(0.07)	(0.12)	(0.12)	(0.04)	(0.02)	(0.20)	(0.19)	
Turnover	0.204**	-0.045	0.262**	0.636*	0.178	0.025	-0.122	0.233	0.208*	
	(0.08)	(0.11)	(0.11)	(0.25)	(0.10)	(0.08)	(0.08)	(0.12)	(0.08)	
Uncertainty	2.883***	3.492***	2.341***	2.607*	2.815	0.124	-0.747*	1.487	1.100	
	(0.41)	(0.51)	(0.68)	(1.01)	(1.80)	(0.39)	(0.36)	(0.78)	(0.97)	
ZLB	-0.732***	-0.449**	-1.152***	-0.827*		0.150	0.064		-0.087	
	(0.13)	(0.18)	(0.12)	(0.38)		(0.10)	(0.09)		(0.27)	
N	11686	4761	3977	1407	1541	7155	4755	1604	796	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.27	0.36	0.30	0.29	0.40	0.18	0.23	0.14	0.22	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.021***	0.020**	0.072**	0.009	-0.300	0.017***	-0.002	0.039	0.029**	0.141
	(0.01)	(0.01)	(0.03)	(0.01)	(0.31)	(0.01)	(0.01)	(0.03)	(0.01)	(0.16)
Transp.	0.010	-0.092	0.051	0.068	0.143*	0.021	-0.004	0.023	0.037	-0.040
	(0.04)	(0.09)	(0.08)	(0.06)	(0.07)	(0.03)	(0.10)	(0.08)	(0.05)	(0.08)
Turnover	0.280***	0.317**	0.266**	0.119	0.333*	0.015	0.124	-0.170*	0.108	0.058
	(0.08)	(0.12)	(0.11)	(0.13)	(0.16)	(0.07)	(0.13)	(0.08)	(0.17)	(0.12)
Uncertainty	-1.224***	-0.267	0.112	-0.683	-4.984***	0.510	1.051*	0.070	1.726***	-2.739
	(0.46)	(0.62)	(0.66)	(1.01)	(1.30)	(0.46)	(0.60)	(0.96)	(0.53)	(1.95)
N	3169	1182	720	898	369	3029	1164	714	800	351
Countries	73	24	15	24	10	73	24	15	24	10
R2	0.14	0.12	0.22	0.28	0.30	0.08	0.10	0.14	0.14	0.23

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed effects-panel regression of the log of absolute cross-sectional mean forecast errors. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. VIX is replaced by the macro uncertainty measure of Jurado et al. (2015).

Table 18: Macro uncertainty Jurado et al. (2015) and forecasts' cross-sectional standard deviation

	Interest Rates					Yields				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.008**	0.004	0.024	-0.014	0.133	0.006**	0.006**	-0.014	0.004	
	(0.00)	(0.00)	(0.02)	(0.01)	(0.10)	(0.00)	(0.00)	(0.02)	(0.00)	
Transp.	-0.086**	-0.008	-0.093*	0.078	-0.153	-0.099**	-0.051	-0.130*	-0.007	
	(0.04)	(0.04)	(0.05)	(0.09)	(0.10)	(0.04)	(0.03)	(0.06)	(0.04)	
Turnover	0.126*	0.016	0.030	0.202	0.200*	0.080**	0.039	0.109**	0.011	
	(0.07)	(0.08)	(0.05)	(0.10)	(0.09)	(0.03)	(0.05)	(0.03)	(0.08)	
Uncertainty	1.972***	1.944***	1.659***	1.730**	2.913**	1.095***	0.818***	1.773***	1.034*	
	(0.20)	(0.15)	(0.39)	(0.48)	(0.93)	(0.16)	(0.09)	(0.42)	(0.39)	
ZLB	-0.281*	-0.340**	-0.579***	0.347		0.128*	0.069		0.253	
	(0.15)	(0.12)	(0.11)	(0.36)		(0.07)	(0.07)		(0.19)	
N	11811	4756	4051	1457	1547	7714	4756	2158	800	
Countries	34	12	12	5	5	23	12	7	4	
R2	0.23	0.37	0.37	0.64	0.12	0.32	0.35	0.40	0.34	

	CPI Inflation					Real GDP Growth				
	All	**WE**	**AP**	**EE**	**LA**	**All**	**WE**	**AP**	**EE**	**LA**
Speech	0.014***	0.011**	0.030	-0.001	-0.087	-0.006	-0.007	0.017	-0.011*	-0.117
	(0.00)	(0.00)	(0.02)	(0.01)	(0.08)	(0.00)	(0.00)	(0.02)	(0.01)	(0.06)
Transp.	-0.118**	-0.033	-0.093	0.061	0.050	-0.010	0.003	-0.074	0.074**	-0.010
	(0.05)	(0.05)	(0.09)	(0.07)	(0.09)	(0.03)	(0.03)	(0.09)	(0.03)	(0.11)
Turnover	0.128	-0.002	0.024	0.073	0.318	0.033	-0.110*	0.021	0.061	0.119
	(0.09)	(0.05)	(0.09)	(0.09)	(0.16)	(0.06)	(0.06)	(0.09)	(0.07)	(0.09)
Uncertainty	0.002	0.153	0.170	-0.068	1.789	-0.071	0.155	-0.356	0.177	-0.215
	(0.31)	(0.32)	(0.54)	(0.66)	(1.05)	(0.25)	(0.40)	(0.46)	(0.53)	(0.64)
N	1914	597	534	480	303	1914	597	534	480	303
Countries	45	12	12	14	7	45	12	12	14	7
R2	0.35	0.38	0.49	0.64	0.37	0.35	0.40	0.45	0.50	0.32

Country fixed-effects panel regression with panel clustered standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The table shows results for a fixed effects-panel regression of the log of forecasts' cross-sectional standard deviation. Interest Rates and Yields have two forecast horizons (3 and 12 months), while CPI Inflation and Real GDP Growth are forecasts for this year and next (24 different forecast horizons). We include a dummy for each forecast horizon. Interest Rates and Yields have a dummy for 12-month forecast horizons; the other two variables have a dummy for each of the 23 forecast horizons. We also include a dummy for each year (the intercept, fixed effects, and dummies are not shown in the table). All denotes all countries, WE are the countries in the Consensus Forecasts data set (mainly Western countries), AP are the countries in the Asia Pacific Consensus Forecasts data set, EE are the Eastern European countries, and LA are the Latin-American Countries. VIX is replaced by the macro uncertainty measure of Jurado et al. (2015).

Appendix 3.4 Good Governance indicators and central bank transparency

Table 19: Correlation between central bank transparency and governance and freedom indicators

Speech	0.42
Turnover	-0.05
VIX	-0.07
Freedom House	
Political Rights	-0.61
Civil Liberties	-0.69
Heritage Foundation	
Overall Score	0.52
Property Rights	0.58
Government Integrity	0.60
Tax Burden	-0.43
Government Spending	-0.49
Business Freedom	0.53
Monetary Freedom	0.42
Trade Freedom	0.58
Investment Freedom	0.50
Financial Freedom	0.53
Worldwide Governance Indicators	
Control of Corruption	0.62
Government Effectiveness	0.66
Political Stability and Absence of Violence/Terrorism	0.48
Regulation Quality	0.67
Rule of Law	0.67
Voice and Accountability	0.69

Correlation with the transparency index.

Appendix 4 How can a central bank increase disagreement among forecasters?

A central bank may increase disagreement by decreasing its signal precision. For example, in the last period, the central bank may have announced that it expected interest rates at 2% with high certainty. This is a public signal provided by the central bank. In the current period, however, it announces an expectation of interest rates at 2% but with high uncertainty. We interpret a signal as a speech held by a central bank representative. We solve this example in a Bayesian expectations framework. Assume a signal from the central bank given by $y = \theta + \eta$ (public information), where θ is the future interest rate drawn by nature and η is the error contained in the signal. Assume $\eta \sim N(0, 1/\alpha)$. Forecaster i also observes a private signal $x_i = \theta + \epsilon_i$ with $\epsilon_i \sim N(0, 1/\beta)$. Thus x_i is private information.[46] The errors in the two signals y and x_i are uncorrelated with each other and with the state θ. In addition, there is a common prior about θ that equals $N(\mu, 1/\tau)$. The joint distribution is written as

$$\begin{bmatrix} \theta \\ x_i \\ y \end{bmatrix} \sim N\left(\begin{bmatrix} \mu \\ \theta \\ \theta \end{bmatrix}, \begin{bmatrix} 1/\tau & 1/\tau & 1/\tau \\ 1/\tau & 1/\tau + 1/\beta & 1/\tau \\ 1/\tau & 1/\tau & 1/\tau + 1/\alpha \end{bmatrix} \right)$$

with $1/\tau$ the variance of the prior, $1/\alpha$ the variance of the error in the central bank's signal and $1/\beta$ the variance of the error in the private signal. Hence, α denotes central bank's signal precision. The larger (smaller) the α, the more (less) precise the public signal by the central bank. The forecasters' prediction of θ following Bayesian expectations equals

$$\mathbb{E}\left[\theta | x_i, y\right] = \frac{\tau}{\alpha + \beta + \tau}\mu + \frac{\beta}{\alpha + \beta + \tau}x_i + \frac{\alpha}{\alpha + \beta + \tau}y$$

and the cross-sectional variance of forecasts is

$$\mathbb{V}\left[\mathbb{E}\left[\theta | x_i, y\right]\right] = \frac{\beta}{(\alpha + \beta + \tau)^2}$$

In our framework, this variance corresponds to forecast disagreement among the forecasters. Disagreement can be changed either by changing the uncertainty of

[46] Private information gives rise to forecast disagreement. If there were no private information, all forecasters would come up with the same forecast, and thus, there would be no disagreement.

forecasters, i.e., a change in τ, by changing forecasters' private signal precision, i.e. a change in β, or by changing the central bank's signal precision, i.e., a change in α. The first derivative of the variance with respect to α is

$$\frac{\partial \mathbb{V}\left[\mathbb{E}\left[\theta|x_i, y\right]\right]}{\partial \alpha} = -2\frac{\beta}{(\alpha+\beta+\tau)^3} < 0$$

We see that the smaller α, the higher the disagreement among forecasters. Hence, higher disagreement may be due to less-precise signals sent by the central bank.

We can connect this statement to the number of speeches held by central bank representatives. Assume two signals are sent by the central bank in a period y_1 and y_2 with a similar form as before ($y_1 = \theta + \eta_1$ and $y_2 = \theta + \eta_2$). Interpreting two signals as two speeches held in a period, the joint distribution is as follows

$$\begin{bmatrix} \theta \\ x_i \\ y_1 \\ y_2 \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_i \\ \theta \\ \theta \\ \theta \end{bmatrix}, \begin{bmatrix} 1/\tau & 1/\tau & 1/\tau & 1/\tau \\ 1/\tau & 1/\tau + 1/\beta & 1/\tau & 1/\tau \\ 1/\tau & 1/\tau & 1/\tau + 1/\alpha & 1/\tau + \rho/\alpha \\ 1/\tau & 1/\tau & 1/\tau + \rho/\alpha & 1/\tau + 1/\alpha \end{bmatrix} \right)$$

where ρ is the correlation between the two signals' errors with $|\rho| < 1$. The forecast is

$$\begin{aligned} \mathbb{E}\left[\theta|x_i, y_1, y_2\right] &= \frac{(1+\rho)\tau}{2\alpha + (1+\rho)\beta + (1+\rho)\tau}\mu + \frac{(1+\rho)\beta}{2\alpha + (1+\rho)\beta + (1+\rho)\tau}x_i \\ &+ \frac{\alpha}{2\alpha + (1+\rho)\beta + (1+\rho)\tau}y_1 + \frac{\alpha}{2\alpha + (1+\rho)\beta + (1+\rho)\tau}y_2 \end{aligned}$$

with cross-sectional variance of forecasts

$$\mathbb{V}\left[\mathbb{E}\left[\theta|x_i, y_1, y_2\right]\right] = \frac{(1+\rho)^2\beta}{\left(2\alpha + (1+\rho)\beta + (1+\rho)\tau\right)^2}$$

What is the relation of the two forecast variances (disagreement) arising from

one signal and from two signals?

$$
\begin{aligned}
\frac{\beta}{(\alpha+\beta+\tau)^2} &\;?\; \frac{(1+\rho)^2\beta}{\left(2\alpha+(1+\rho)(\beta+\tau)\right)^2} \\
\left(2\alpha+(1+\rho)(\beta+\tau)\right)^2 &\;?\; (1+\rho)^2(\alpha+\beta+\tau)^2 \\
2\alpha+(1+\rho)(\beta+\tau) &\;?\; (1+\rho)(\alpha+\beta+\tau) \\
2\alpha &\;?\; (1+\rho)\alpha \\
2 &\;>\; (1+\rho)
\end{aligned}
$$

We see that the disagreement with two signals is strictly smaller than with one signal, even if there is high correlation in the error, i.e. a ρ close to but smaller than 1. We can safely exclude $\rho = 1$ because this would imply that the central bank conveys two exactly identical signals. Therefore, more speeches should decrease disagreement. Empirically, we find the opposite. The more speeches, the higher the disagreement. In our Bayesian framework, this finding is possible if either i) the precision of signals decreases in the number of speeches (α becomes smaller the more signals are sent), ii) the forecasters' certainty decreases (τ becomes smaller the more signals are sent by the central bank), iii) or both.[47] Note that a central bank decides on the precision (α) and number of its signals. However, a central bank cannot steer forecasters' certainty (τ) directly. Therefore, we assume that a central bank can influence forecasters' uncertainty τ by sending more signals or changing its precision α. In other words, we assume τ to be endogenous.

To see the first case – i) a decrease in signal precision α – rename precision α α_1 in the model with one signal and α_2 in the model with two signals

$$
\begin{aligned}
\frac{\beta}{(\alpha_1+\beta+\tau)^2} &< \frac{(1+\rho)^2\beta}{\left(2\alpha_2+(1+\rho)(\beta+\tau)\right)^2} \\
\left(2\alpha_2+(1+\rho)(\beta+\tau)\right)^2 &< (\alpha_1+\beta+\tau)^2(1+\rho)^2 \\
2\alpha_2+(1+\rho)(\beta+\tau) &< (\alpha_1+\beta+\tau)(1+\rho) \\
2\alpha_2 &< \alpha_1(1+\rho) \\
\frac{2}{1+\rho} &< \frac{\alpha_1}{\alpha_2}
\end{aligned}
$$

We know that $2/(1+\rho) > 1$. Therefore, we need $\alpha_1 > \alpha_2$ to support our empir-

[47] Without loss of generality, for the sake of simplicity we assume that β is exogenous.

ical finding that more speeches cause higher disagreement.[48] We conclude that if central banks talk more, they become less precise in their announcements.

For the second case – ii) a decrease in forecasters' certainty τ – rename τ τ_1 in the model with one signal and τ_2 in the model with two signals

$$\begin{aligned}
\frac{\beta}{(\alpha+\beta+\tau_1)^2} &< \frac{(1+\rho)^2\beta}{(2\alpha+(1+\rho)(\beta+\tau_2))^2} \\
(2\alpha+(1+\rho)(\beta+\tau_2))^2 &< (1+\rho)^2(\alpha+\beta+\tau_1)^2 \\
(2\alpha+(1+\rho)(\beta+\tau_2)) &< (1+\rho)(\alpha+\beta+\tau_1) \\
2\alpha+(1+\rho)\tau_2 &< (1+\rho)\alpha+(1+\rho)\tau_1 \\
2\alpha+\tau_2+\rho\tau_2 &< \rho\tau_1+\rho\alpha+\tau_1+\alpha \\
(1-\rho)\alpha &< (1+\rho)(\tau_1-\tau_2) \\
\frac{1-\rho}{1+\rho} &< \frac{\tau_1-\tau_2}{\alpha}
\end{aligned}$$

The left-hand side is always positive, and therefore, we need $\tau_1 > \tau_2$.[49] In other words, if there is only one signal, the forecaster is more certain about his own prior than if he faces two signals. The more signals the central bank sends out, the more confused the forecasters become, even though the signal precision does not change.

iii) Change both the central bank's signal precision and the forecasters' certainty. This leads to

$$\begin{aligned}
\frac{\beta}{(\alpha_1+\beta+\tau_1)^2} &< \frac{(1+\rho)^2\beta}{(2\alpha_2+(1+\rho)(\beta+\tau_2))^2} \\
(2\alpha_2+(1+\rho)(\beta+\tau_2))^2 &< (1+\rho)^2(\alpha_1+\beta+\tau_1)^2 \\
2\alpha_2+(1+\rho)(\beta+\tau_2) &< (1+\rho)(\alpha_1+\beta+\tau_1) \\
2\alpha_2+(1+\rho)\tau_2 &< (\rho+1)\tau_1+(\rho+1)\alpha_1 \\
2\alpha_2 &< (\rho+1)\tau_1-(1+\rho)\tau_2+(\rho+1)\alpha_1 \\
2\alpha_2 &< (\rho+1)(\alpha_1+\tau_1-\tau_2) \\
\frac{2}{\rho+1} &< \frac{\alpha_1+\tau_1-\tau_2}{\alpha_2} \\
\frac{2}{\rho+1} &< \frac{\alpha_1}{\alpha_2}+\frac{\tau_1-\tau_2}{\alpha_2}
\end{aligned}$$

[48] $\alpha_1 > \alpha_2$ is a necessary but insufficient condition.
[49] $\tau_1 > \tau_2$ is a necessary but insufficient condition.

We know that $2/(1+\rho) > 1$. Thus,

$$\begin{aligned} 1 &< \frac{\alpha_1}{\alpha_2} + \frac{\tau_1 - \tau_2}{\alpha_2} \\ \frac{\alpha_2 - \alpha_1}{\alpha_2} &< \frac{\tau_1 - \tau_2}{\alpha_2} \\ \alpha_2 - \alpha_1 &< \tau_1 - \tau_2 \\ \alpha_2 + \tau_2 &< \alpha_1 + \tau_1 \end{aligned}$$

Hence, if both forecaster uncertainty and the central bank's signal precision change, the two-signal case necessarily has higher overall uncertainty (sum of the precision of signal and the forecasters' certainty about their prior) than the one-signal case in order to support our empirical result. This means that sending more signals increases overall uncertainty.

Appendix 5 Optimal transparency and its variance

We derive optimal transparency and its variance. For an optimum, we need a squared term. The benchmark regression becomes

$$\begin{aligned} Y_{i,h,t} &= \beta_{TI} \cdot \text{Transp.}_{i,t} + \beta_{TIsq} \cdot \text{Transp.}_{i,t}^2 + X_{i,h,t} + \varepsilon_{i,t} \\ \frac{\partial Y_{i,h,t}}{\partial \text{Transp.}_{i,t}} &= \beta_{TI} + 2 \cdot \beta_{TIsq} \cdot \text{Transp.}_{i,t} \stackrel{!}{=} 0 \\ &\Leftrightarrow \text{Transp.*} = -\frac{\beta_{TI}}{2 \cdot \beta_{TIsq}} \end{aligned}$$

To calculate the variance of Transp.*, we use the Delta method.

The Delta method states the following (see, for example, Greene (2012)):
If $\sqrt{n}(z_n - \mu) \xrightarrow{d} N(0, \Sigma)$ and if $g[z_n]$ is a continuous and continuously differentiable function with $g'[\mu]$ not equal to zero and not involving n, then

$$\sqrt{n}\left(g[z_n] - g[\mu]\right) \xrightarrow{d} N\left(0, G \cdot \Sigma \cdot G'\right)$$

where $G = \partial g[z_n]/\partial z_n$.

Note that z_n, μ and G are vectors and Σ is the covariance matrix.

Define

$$g[\beta_{TI}, \beta_{TIsq}] = -\frac{\beta_{TI}}{2 \cdot \beta_{TIsq}}$$

The variance of $g[\beta_{TI}, \beta_{TIsq}]$ is given by

$$\begin{aligned} \mathbb{V}\left[g[\beta_{TI}, \beta_{TIsq}]\right] &= G \cdot V \cdot G' \\ G &= \left(\frac{\partial g[\beta_{TI}, \beta_{TIsq}]}{\partial \beta_{TI}}, \frac{\partial g[\beta_{TI}, \beta_{TIsq}]}{\partial \beta_{TIsq}} \right) = \left(\frac{-1}{2 \cdot \beta_{TIsq}}, \frac{\beta_{TI}}{2 \cdot \beta_{TIsq}^2} \right) \\ V &= \begin{pmatrix} \mathbb{V}[\beta_{TI}], & \text{Cov}[\beta_{TI}, \beta_{TIsq}] \\ \text{Cov}[\beta_{TI}, \beta_{TIsq}], & \mathbb{V}[\beta_{TIsq}] \end{pmatrix} \\ \Rightarrow \mathbb{V}\left[g[\beta_{TI}, \beta_{TIsq}]\right] &= \frac{\mathbb{V}[\beta_{TI}]}{4 \cdot \beta_{TIsq}^2} - \frac{\beta_{TI} \cdot \text{Cov}[\beta_{TI}, \beta_{TIsq}]}{2 \cdot \beta_{TIsq}^3} + \frac{\beta_{TI}^2 \cdot \mathbb{V}[\beta_{TIsq}]}{4 \cdot \beta_{TIsq}^4} \end{aligned}$$

We use this variance estimate to run t-tests of optimal transparency levels.

Appendix 6 Construction of Central Bank Transparency Index by Dincer & Eichengreen (2014)

In the following, we reproduce how the Central Bank Transparency Index was constructed by Dincer & Eichengreen (2014). There are five subindices with three subcomponents (questions) in each, which leads to 15 questions overall. The points given to each subcomponent are summed up to reach the index level.

1 Political Transparency Political transparency refers to openness about policy objectives. This comprises a formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

1a Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

No formal objective(s) = 0.

Multiple objectives without prioritization = 1/2.

One primary objective, or multiple objectives with explicit priority = 1.

1b Is there a quantification of the primary objective(s)?

No = 0.

Yes = 1.

1c Are there explicit contacts or other similar institutional arrangements between the monetary authorities and the government?

No central bank contracts or other institutional arrangements = 0.

Central bank without explicit instrument independence or contract = 1/2.

Central bank with explicit instrument independence or central bank contract although possibly subject to an explicit override procedure = 1.

2 Economic Transparency Economic transparency focuses on the economic information that is used for monetary policy. This includes economic data, the model of the economy that the central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal forecasts (model based or judgmental) that the central bank relies on.

2a Is the basic economic data relevant for the conduct of monetary policy publicly available? (The focus is on the following five variables: money supply, inflation, GDP, unemployment rate, and capacity utilization.)

Quarterly time series for at most two out of the five variables = 0.

Quarterly time series for three or four out of the five variables = 1/2.

Quarterly time series for all five variables = 1.

2b Does the central bank disclose the macroeconomic model(s) it uses for policy analysis?

No = 0.

Yes = 1.

2c Does the central bank regularly publish its own macroeconomic forecasts?

No numerical central bank forecasts for inflation and output = 0.

Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2.

Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

3 Procedural Transparency Procedural transparency concerns the way monetary policy decisions are taken.

3a Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

No = 0.

Yes = 1.

3b Does the central bank give a comprehensive account of policy deliberations (or explanations in the case of a single central banker) within a reasonable amount of time?

No or only after a substantial lag (more than eight weeks) = 0.

Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single central banker), including a discussion of backward- and forward-looking arguments = 1.

3c Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

No voting records, or only after substantial lag (more than eight weeks) = 0.

Non-attributed voting records = 1/2.

Individual voting records, or decision by single central banker = 1.

4 Policy Transparency Policy transparency means prompt disclosure of policy decisions, together with an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

4a Are decisions about adjustments to the main operating instrument or target announced promptly?

No or only after the day of implementation = 0.

Yes, on the day of implementation = 1.

4b Does the central bank provide an explanation when it announces policy decisions?

No = 0.

Yes, when policy decisions change, or only superficially = 1/2.

Yes, always and including forwarding-looking assessments = 1.

4c Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

No = 0.

Yes = 1.

5 Operational Transparency Operational transparency concerns the implementation of the central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. The evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

5a Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

No or not very often (at less than annual frequency) = 0.

Yes but without providing explanations for significant deviations = 1/2.

Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

5b Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

No or not very often = 0.

Yes but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) = 1/2.

Yes, including a discussion of past forecast errors (at least annually) = 1.

5c Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

No or not very often (at less than annual frequency) = 0.

Yes but superficially = 1/2.

Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.